American Railroad Journal.

WHOLE No. 2,566.] NEW YORK, JULY, 1885. [VOLUME LIX.—No. 4.

ACCIDENTS FROM SPREADING OF RAILS.

BY WM. S. HUNTINGTON.

[Written for the AMERICAN RAILROAD JOURNAL.]

IN the early days of American railways, a derailment from spreading of track was a very rare occurrence, and when, after a few years, accidents from this cause were reported from time to time, old hands opened their eyes with astonishment on learning that spreading of rails had caused a smash-up. Accidents from any other causes were considered as matters of course and unavoidable, with the exception of such as were the result of carelessness or disobedience of orders. It was understood that breakages would occur under the most careful management, but there was no excuse for a case of spreading of rails, and there was a great deal of sharp criticism of the management of all roads that allowed their tracks to spread sufficiently to cause derailment. The word "allowed" is used here for the reason that ties were *allowed* to remain in the track, after they had become so decayed as to offer no resistance to the spikes pulling out. With the old style of light rolling-stock and moderate speed of trains, rails would not spread or roll over if well spiked on a good supply of sound ties, and the reason tracks spread was because they were allowed to do so through gross mismanagement, or the exercise of that kind of economy that saves a thousand dollars *in material not furnished*, and pays five thousand dollars or more for loss of life and injury to persons and property in consequence; and it was only those roads that were mismanaged that first suffered from spreading of rails.

But, after a time, when fifty per cent. or more was added to the weight and speed of trains and the destructive "Moguls" came into use, the best managed roads in the country began to have trouble in keeping rails in place. Track that was safe under ordinary traffic failed under the new conditions of things, and the only remedy seemed to be more ties and spikes; but this afforded only temporary relief. The excessive vertical and lateral strain soon loosened the spikes, moisture followed, causing premature decay of the ties, and thus they no longer held the rails in place, and derailment and disaster was frequent. Notwithstanding the fact that the condition of American railways has been greatly improved within the past fifteen or twenty years, accidents from the cause under consideration have been on the increase. Nine years ago, thirty derailments were reported from this cause in twelve months, and in the twelve months including part of the years 1882–83, ninety-two derailments are reported from this cause, and for the nine years ending in June 1883, 360 serious accidents were caused by spreading of rails. Nearly all these accidents occurred on roads that were in better condition than formerly, and on which such accidents had rarely, if ever, occurred.

As a rule, the tracks where these accidents occurred were well ballasted and well tied, with heavy steel rails spiked in the ordinary manner, and why such track should spread was a mystery to those who were not given to the study of cause and effect, and the following will explain why the improved tracks of to-day spread more frequently than did those of lighter material in former years:

When tracks were laid with light iron rails the rolling-stock was light, causing but slight depression of the rails so that on returning to their normal condition when relieved of their load, they exerted but little force on the spikes in their upward spring, and the spikes were not pulled out of the ties. Moreover, but little or no ballast was used at that time to hold the ties firmly in place, the latter lying loosely on the surface of the road-bed and offering but slight resistance to the upward spring of the rails as exerted on the spikes, while the ties were kept in contact with the rails. In other words, the forces exerted on the spike-heads were not sufficient to loosen the spikes so as to cause derailment, save in rare cases where soft ties were used and not fully spiked. So long as the spike-heads had a bearing on the base of the rail there was no spreading, but it was when the spikes had not sufficient hold on the tie to lift it and keep it in contact with the rail on its reaction after depression that rails could spread. When moisture enters the tie following down the spikes, a pulpy substance is soon formed around the spikes. This is the commencement of decay and the spike losses its hold on the timber, and the spring of the rail pulls it out gradually, until the tie no longer returns with the rail when recovering from its depression, but remains at the lowest point of depression when under its load, and the rail comes up without it, leaving a space of an inch, more or less, between the ties and rails. Some of the ties, being narrower than others, or lying on a softer foundation, sink further in their beds than others, so that when the rail is relieved from its load it only has a bearing on the highest ties. On these ties the spike-heads will be above the base of the rail, while the ties that have been depressed the most will hang loosely by the spikes to the rails or be suspended by the spike-heads. Trackmen shove the spikes to their place, but the next train pulls them up again, and, owing to more moisture and decay, the spikes soon lose their hold entirely.

Now that a liberal supply of heavy ties are embedded in an abundance of ballast and surmounted with heavy steel rails, well spiked, it would seem that there should be no more trouble from spreading of track; but investigation proves that the causes have increased faster than the remedies. That is to say, the means of prevention have not kept pace with the destructive forces that have been brought forward by the demands of a heavy and fast traffic, which is rapidly increasing. When the heavy steel rails now in use are depressed by monstrous

locomotives under high velocities, being suddenly released from pressure they regain their normal position with great force, which, acting on the spikes with greater force than light iron rails that have but little spring, draws them from the heavy ties which are so firmly anchored in the ballast that the spikes have not sufficient hold on them to raise them from their bearings, and thus the spikes pull out. Moreover, the lateral strain on the rails is much greater than formerly. This has a tendency to force the spikes into the grain of the wood, away from the outer side of the rails, thus widening the gauge and increasing the lateral oscillation which also augments the lateral strain, and by enlarging the space around the spikes admits more moisture and hastens the decay of the ties. It will thus be seen that with the greater solidity of the ties, together with the increase in force, number and frequency of the vertical and lateral strains on the spikes, the track is more liable to spread than with the lighter traffic, lower velocities and less stability of superstructure and iron rails of twenty years ago, and that while tracks are safer in many other respects than formerly, spreading is on the increase for the reasons set forth.

When instances of spreading of rails had become somewhat frequent, some of the progressive trackmen sought to prevent it by driving extra spikes on the outer sides of the rails, and in cases where the supply of spikes was limited, they were pulled from some of the ties (every second or third) on the inner side of the rails and driven on the outside, and some contractors, in laying track, thought it a stroke of economy to leave out the inner spikes on every alternate tie or every third tie, according to the quality of the timber and nature of alignment. In doing this they argued that they were making just as good a track with less material than if full-spiked, as every tie was spiked on the outerside of the rail and thus could not spread. So far as the *lateral displacement* of the rail was concerned this was correct, but the important fact that rails frequently *roll over* was overlooked. It is rare that there is sufficient lateral displacement to cause derailment although that is the primary cause, and rails roll either way, according to circumstances. Lateral displacement increases the force of end-thrusts of axles, which roll the rail outward, but if the rails have spread far enough to allow the outer edges of the treads of wheels to have their bearing inside the vertical center of the rails they roll inward. On curves the inner rails are likely to roll inward for the reason that wheel-flanges follow the outer rail, which brings the wheels on the inner side to the edge of the rails, and derailment occurs from the displacement of the rails on that side. On straight lines bad surface and alignment changes the powerful thrusts from side to side and the rails will roll either way, according to the nature of the imperfections of the track. If there is a kink in the alignment and a low joint opposite to it, a heavy lurch is caused in the direction of the low joint or center, as the case may be, but the kink alone, if on a good surface, will cause displacement and a greater strain on the spikes than an uneven surface with good alignment. The forces that tend to pull spikes out of ties are numerous and constantly at work, and a great many plans have been tried to prevent rails from spreading, but no arrangement of spikes has thus far proved satisfactory. Double-spiking is not a specific remedy for the evil. Wood blocks and fish-plates have been spiked to the ties to brace the rail; cast-iron guard-rail braces have been tried with several spikes to each brace, and some patent wrought-iron braces fastened with spikes are in use, but they all get loose from the constant shocks, jars, vibrations, vertical and lateral strains, rot, frost, rain, etc., and railway officials who have studied the matter have decided that the spike is a primitive fastening, and not up to the present and future requirements of American railway practice, and that something better must be found for future use as a rail-fastening.

A PLEA FOR LIGHTER ROLLING-STOCK.

BY CHEMIN DE FER.

[Written for the AMERICAN RAILROAD JOURNAL.]

I DON'T know whether or not George Stephenson was an inspired prophet, but certain it is that his prediction that a railway speed of sixty miles an hour would be but little exceeded even when years of study had been spent upon the betterment of railway operation, has thus far proved true. With the exception of a few "spurts," no trains attain a speed as high as sixty miles per hour and we have yet to see—in this country at least—such a speed maintained for a lengthy journey. In distances of five hundred miles and upwards our fastest express-trains do not attain a speed of over forty-five miles an hour, and while of late there has been a noticeable improvement made in the time between distant points, this improvement seems to have been accomplished through other means than the mere increase of velocity. Thus our railways are saving time with commendable energy in running express-trains with few stoppages between important centers, and every provision is made to insure quick connections and prompt handling of traffic; but when it comes right down to the question of improving the capabilities of American locomotives little has been done. *The Locomotive* truly remarks in a recent article that compared with the engine of fifty years ago the modern locomotive offers but little improvement; and I see it is hinted that the old inside-connected locomotives of twenty or thirty years ago, were capable of better work than the shining and beautiful monsters of to-day. The old locomotives may not have been pretty to look at, but certainly they did effective service, and despite the manifold improved mechanisms which grace their successors, the achievements of these veterans of the service have yet to be surpassed.

The radical improvement of the locomotive is a problem awaiting an inventor's solution. I do not believe that we will have engines capable of pulling, at phenomonal speed, trains like those now run until there is a radical change in construction. Just what that change must be no one can say, otherwise there would be no problem to solve, but in one respect at least our railways seem to be making wonderful "backward progress," so to speak. The many improvements recently introduced in car-construction have resulted in a great increase of weight in these vehicles, and the parlor and sleeping-cars of to-day are enormously heavy. Even the ordinary passenger-car has taken an extra weight upon itself, and somehow or other, the handsomer the cars the more they weigh. It is folly to assume that this increased weight does not add materially to the burden of the locomotive, and in considerable

measure retard the speed of a train. A train consisting of half-a-dozen Pullman's is a formidable load for an engine to pull at a high rate of speed, nor does any necessity seem to exist for such ponderosity. True, a heavy car is apt to ride more easily and jolt less that a light car, but an increase in the elasticity of the springs would remedy this defect and furnish a light car in nearly every respect as comfortable as a heavy one. It may also be said that a heavy car is safer than a light car and less liable to derailment, which is true, but other precautionary measures can be taken than increasing the weight of the car, and in fact derailments are more common than formerly despite this increase of dead weight.

Certainly there is no reason why a light car cannot be made in every way as handsome, comfortable and safe as a heavy one, and with a question so eminently practical as this, it seems strange that all efforts in the direction of improving the construction of passenger-cars have been made seemingly with the purpose of increasing the weight proportionately to the interior and exterior improvement.

If George Stephenson was right, and we are never to reach a very high rate of railway speed, we can at least see to it that our failure in this respect is not owing to any laches on our part, and prominent among the drawbacks in our present methods of railway operation is an unnecessary weightiness of trains. A plea for lighter rolling-stock is a word in behalf of high speed, and possibly if we were to go back to the light cars of former days we would find that our present locomotives are, after all, better than their predecessors. Unfortunately all improvements introduced into locomotive-building have been accompanied by an increased demand upon their services. They improve in the same way a youth betters himself in getting an increase of salary just enough to cover the increase of cost in the necessities of life. A locomotive of to-day may be more powerful than one of years past, but a great deal more is expected of it. The introduction of lighter rolling-stock will to a considerable degree give it some chance for showing what it can do in comparison with the primitive engines whose efforts are yet unsurpassed, and it is a little strange that in this age of utility and common-sense rivalry, roads will enter into active competition and vie with each other in the beauty of their rolling-stock, and materially damage their prospects of acquiring a reputation for high speed by the wholly unnecessary weight given their cars.

THE OTHER SIDE OF THE PROMOTION QUESTION.

BY G. C. W.

[Written for the AMERICAN RAILROAD JOURNAL.]

I HAVE been much interested in reading the articles published in the April and June JOURNALS by an anonymous railway superintendent on the subject of promotion in railway service, and, if permitted, I would like to advance a few arguments on the other side of the question. "Superintendent" claims to speak entirely from the traveling public's standpoint and not in his official capacity. Permit me, then, to speak from an official point of view and also to make the broad assertion that the interests of the traveling public and of the railway itself are identical in this respect. It matters little from which side the argument is advanced, it is to the interest of the railway to secure the best possible class of trainmen, and it is to the interest of the traveling public that such a class should be secured. Therefore, I cannot see the precise logic by which "Superintendent" assumes that there is disloyalty to the interest of his road in advancing the interest of the traveler.

But it is evident that the writer in question has no love for the strict system of promotion, whether it be exercised in one interest or the other, and much that he says about the matter under discussion is undeniably true. Doubtless it would be very discouraging for an unusually competent man to feel that he is tied down to a poor position simply because inferior men who have been longer in the employ of the road than himself stand in his way, but there is no earthly necessity why this state of things should exist. It is entirely practicable for a railway to adopt a system of strict promotion and yet provide for the ample recognition of special or peculiar talents. Advancement along the grades for special merit is not at all inconsistent with the theories of promotion, and the "civil service reform" rules, as my friend calls them, can be reserved for the steady and reliable man who does his work well and does not belong to the class of geniuses. If, as "Superintendent" claims, it is hard for a man to feel that length of service alone will insure his advancement, is it not equally hard for another man to feel that length of service will not be reckoned as any claim to promotion? It has been my experience that the only "show," so to speak, that train-hands have of showing their ability is doing what they are told to do, and doing it faithfully and well. The opportunity for the exercise of brilliant talents is rarely afforded them and comes more through chance than through design. Now if we are to establish the rule that special achievement alone is to warrant promotion are we not doing an injustice to the men who from the nature of their particular line of employment have absolutely no chance whatever to distinguish themselves? Do we not quite as effectually destroy zeal in the one case as in the other? Surely it would be very disheartening to a man to know that his chance of promotion did not lie along the regular path of his duty, and, at the same time, such a knowledge would be subversive of railway discipline. I presume "Superintendent" will admit the necessity for discipline in railway management. I also presume he will admit that, in the main, discipline consists in the strict observance of railway rules and regulations. Therefore, he should be willing to admit that railway discipline can best be obtained by the encouragement of strict attention to duty. Having granted this much, I claim he must admit that promotion should be awarded fairly and impartially; and such award is impossible if a road must wait until some special act on the part of its employés calls for immediate recognition in the shape of promotion. It is in routine work that a railway employé should excel—therefore his excellence in routine work should entitle him to liberal treatment; yet "Superintendent" would seem to be in favor of reserving promotion until an employé did something of a "sky-rocket" nature. According to his view—I may wrong him, but he is certainly open to such imputation—the actual duties of a railway employé are matters to occupy the latter's time when he has nothing else to do.

Furthermore, there is but one safe rule by which all

favoritism or appearance of it can be avoided, and that is by the exercise of strict promotion according to length and excellence of service; save, possibly, in special cases where a railway employé's aptitude and ability are so marked that he may be safely advanced without fear of creating jealousy and dissatisfaction among his fellow employés.

Another point that I would like to combat is the theory held forth by "Superintendent" that it is better to avoid a "class creation"—the railway employé—and that a little outside blood is a good thing for a railway to infuse in its system. I think this view of the case is a mistake. To a certain extent the railway employé should be regarded by the railway management as belonging to a privileged class. He should feel that there will be no outside competition with his services, and that he is secure in his position during good behaviour. Still again, a railway necessarily suffers if it is constantly recruiting its ranks from other fields and perpetually imparting the necessary instruction and information to a set of green hands. A railway should train its hands, not teach them, and with the system of promotion the employé is gradually fitted for the place he holds by years of actual experience and training. He learns himself what his duties are, and does not have to be taught them.

In conclusion I would heartily coincide with "Superintendent" in holding that "the reward of meritorious service is the most powerful means of securing intelligent labor," but I do not coincide with his definition of meritorious service. To my mind the most meritorious service a railway employé can render his road is strict attention to duty, and it is this species of service that I would recognize in the adoption of the system of promotion. My anonymous friend concludes his latest contribution with an aphorism to the effect that "promotion should be a reward—not a pension." Let me follow his example and state as my humble opinion, that promotion should be a growth—not a creation.

LEGAL REQUIREMENTS UPON THE MECHANICAL DEPARTMENT OF RAILWAYS.

BY WILLARD A. SMITH.

[A Paper read before the recent Convention of the American Railway Master Mechanics' Association.]

RECENT legislation and decisions of the courts have made manifest an increasing disposition, on the part of the makers and interpreters of the law, to hold railway companies responsible for a high degree of perfection, not only in their methods of operation, but also in the machinery which they employ. On the subject of this legal responsibility, there seems to be in the public mind considerable misinformation; and on the part of railway officials, to some extent, a lack of definite knowledge. It is true that questions arising under this head are of such varying natures and influenced by so many circumstances of fact, that it is difficult, often, to determine just what the result of a suit for damages, in which it is involved, will be. It is also true that, when a case actually arises, it must be left to the legal department of the road to handle. But, as prevention is better than cure, and the results of ignorance and negligence are altogether out of proportion to the amount of labor and care required to avoid them, it is certainly desirable that the officer in charge of the mechanical department of a road should understand clearly the relations in which it stands to the law.

It is the intention of this paper to present briefly and without legal technicalities the principles of the law on this subject as they exist to-day; and something of the future tendency.

It is not uncommon for an inventor or the promoter of a new invention to say: "The law will force railway companies to use my device; even if there is no special legislation for it, the courts will hold railway companies responsible for accidents which might have been prevented by its use; and, therefore, they must come to it." This kind of argument is constantly used in the endeavor to induce capital to invest in so-called improvements; and has, no doubt, led to much injudicious investment. At the other extreme are those railway officials who do not recognize the existence of any legal obligation except that which is directly expressed in statutory law, and forced upon their attention by strict and well-defined penalties.

The common law relating to the responsibility of carriers of merchandise and passengers, antedates the existence of railways. When the stage-coach was superseded by the locomotive, the general principles of the law relating to carriers remained the same, and were only changed so far as necessary in application to conform to the new conditions. The earlier decisions were inclined to hold railways to a higher decree of care than stage lines, because steam was considered a more dangerous servant than the horse; and the greater the risk the greater should the precautions be. In later times, the tendency to require greater care has been due to a recognition on the part of the legislatures and the public of the increasing comparative value of human life.

In the progress of civilization it is not improbable that this tendency will continue to grow until, ultimately, negligence may come to be considered synonymous with crime; and dollars and cents will not balance the scale against humanity. A world which has reliazed so much from inventive genius and expects so much from it will not tolerate any kind of obstruction to its full fruition.

There are two general divisions of injuries for which a railway company may become liable in damages—those to property and those to persons. With relation to goods received for transportation little need be said. Under the common law, the carrier is absolutely the insurer against all loss except from "act of God," (as by lightning) or the public enemy. In modern practice, the carrier limits the liability by special contract contained in the bill of lading; but he cannot avoid liability for his own negligence. The railway company has the strongest possible financial considerations for endeavoring to avoid injury to merchandise. The cases in which it can excuse itself for any loss or injury thereto are comparatively few.

Merchandise delivered to a railway company for transportation is wholly within the control of that company. Not so with passengers; they are endowed with reason and the power of locomotion. These powers they may exercise for their own safety or they may neglect to use to their own injury. A passenger may place himself in a position of danger, notwithstanding the greatest effort of the carrier to prevent him from doing so. Hence he must be held responsible for his own safety so far as it lies

within his power; and contributory negligence on his part will relieve the railway company from liability. But, aside from this, the carrier is held to a very high degree of care, not only in the operation of the road, but in the selection or manufacture and care of its machinery and all its appliances. The railway company does not absolutely insure the passenger; but it does insure him against all risks due to its own neglect.

It is in the interpretation of this word "neglect" that the gist of the matter lies. Various expressions have been used by the courts in defining the degree of care required of a carrier of passengers; and these have passed into the text-books of the law. It is said that the carrier is "held only to the utmost care of a cautious person;" that it is "liability only for want of due care, diligence and skill;" and that it is responsible "only as far as human care and foresight will go." These are general principles requiring further elucidation. The law does not require anything which is physically or morally impossible; nor a degree of perfection which may be ideal but is not practicable. It considers that the business of a railway is to furnish transportation, and does not require an expenditure and responsibility so great as to make the business impracticable. It also considers the position of a railway and does not require so much in the way of expenditure from a small road with light traffic as it does of a great trunk line. In other words, it follows the dictates of common sense in determining the exact meaning of the word "duty." These limitations, however, are not intended as loop-holes for escaping responsibility, and within these lines a strict account is held. In general terms it may be said that a railway company must be abreast of the times. In the construction of its machinery it must, in the first place, exercise the greatest care in the purchase of materials. The most approved tests must be used; and quality must be considered before price. It would doubtless be considered negligence for a railway company to purchase and use a wheel costing only seven or eight dollars, when the best expert testimony was that a good reliable wheel could not possibly be made for less than ten or twelve dollars. Such action would betray a recklessness which no court could excuse. It has been held that axles must be tested by the most approved methods in use, and that a railway company "must apply to boilers of locomotives every test recognized as necessary by experts." And this liability is not avoided by purchasing machinery already made, from manufacturers. The negligence of the manufacturer attaches to the railway company buying and using his machinery. Nor will the high reputation of the manufacturer avail the railway company as a defense.

The only exception to these rules is in the case of "latent defects which could neither be guarded against in the process of construction nor discovered by subsequent examination;" and this will be construed in the light of the highest scientific skill. Many defects which were once considered latent can now be discovered; the causes are known and can be guarded against. Such cases, will be considered with reference to the "present state of the art"—ignorance of which is no excuse. So, when a machine or vehicle has been put in operation, continual watchfulness is required, and a cautious observance "of all accustomed and known tests for the discovering of their insufficiency, as often as circumstances require." In an interesting case, the tire of a driving-wheel had been tested when new; subsequently it was returned and not again tested. It was held that the neglect to make this second test rendered the railway company liable for an injury resulting from the breaking of the tire. The factor of safety must be sufficiently large to cover all the probabilities, if not quite the possibilities, and no chances must be taken.

We now come to the important question in how far a railway company is legally bound to adopt new inventions and improvements. The rule governing this subject has its limits; but within these limits it is one of great and growing importance. The courts are more and more inclined to hold carriers to a strict responsibility; and this is being supplemented to a considerable extent by legislative action. Generally speaking, a railway company is under legal obligation to adopt such new inventions and improvements in the construction of its equipment, as will conduce to the safety of travel. This does not, however, cover every possible device; nor any which are only theoretical or in the experimental stage. It is not obliged to experiment with everything which looks well, nor to accept the mere experiment and limited experience of others. Nor is it obliged to use any device which might accomplish its object in one direction, but at too great a risk or actual detriment in others. It must keep up—not with the very highest scientific skill, nor the most advanced flight of inventive genius—but with the actual and general mechanical progress of the times. The law requires the adoption and use of such inventions and improvements as are well-known and generally approved—as for instance, continuous power brakes; platforms which prevent telescoping; and many other devices which will readily occur. But there are always a large number of inventions in existence which have not been demonstrated to be successes, and concerning the value of which there may rightly be a difference of opinion. It thus appears that success is the criterion which the law applies; and that it is not in the earlier stages of the history of an invention that it is aided by this principle, but after it has really won practical recognition.

The same principle regarding the adoption of inventions applies to other classes of injuries besides those to passengers. Neglect to use suitable gates at crossings; valves for preventing the noise of escaping steam which frightens horses; spark-arresters for the prevention of setting fire to property along the track—will render a company liable, because such injuries are clearly preventable, within the limits of reasonable care and expense.

It will readily be seen, from what has been said, that the questions which arise, under our subject, are largely questions of fact as well as of law; and that the amount which a railway company will have to pay in damages in such cases will depend to a considerable extent upon the degree of care, intelligence and foresight exercised by those in charge of its mechanical department.

In many States this principle has been to a certain extent defined by specific legal obligation in the shape of statutes—as for instance, by a law requiring the use of stoves in which the fire will be automatically extinguished in case of fire. Such statutes do no increase the common law liability; but reduce the question of fact to a simple issue.

The subject of injuries to employés is upon an entirely different basis from those which we have thus far consid-

ered. The employé is supposed to understand all the ordinary risks of his employment and to accept them. The employer is supposed to furnish good machinery and improved devices; but is not liable for injuries resulting from defects which were obvious to the employé. If the employé notifies the company of such defects and they are not remedied, it is his duty after a reasonable time to leave the employment. But if he is injured by some defect which is not obvious to him, and which the company should have known and remedied, he can recover. Except when otherwise laid down by statute, the employer is not responsible for an injury to an employé resulting from the negligence of a fellow employé. Questions as to who are fellow employés, and many others involved in those relations, have called forth numerous decisions.

But of late it has become quite general for railway companies to require employés to assume all risk, by the contract of employment. The law permits this except in the case of criminal neglect—a thing which is hard to prove. This virtually puts an end to damage suits on the part of employés; and has removed one principal inducement for a railway company to adopt certain classes of improvements. Employés generally are willing to assume the risk; and do not make any decided demand for the adoption of safety appliances. Their reckless disposition has been frequently illustrated. In one State where many brakemen had been killed by overhead bridges, a law was passed requiring the suspension of hanging straps across the road near the bridges, which gave warning to the brakeman by a slight blow. The brakemen began very soon to be annoyed by them and and to cut them off; and it was actually found necessary to protect them by making it a crime to destroy them. The law must sometimes step in to protect the improvident and reckless from themselves. Acting upon this principle, the legislatures of several States have lately passed laws looking to preservation of life and limb, by requiring railway companies to adopt automatic couplers. State railroad commissioners are also making investigations with a view to urging still further legislation of a similar character. Whether the desired end can be attained or even hastened in this manner may be a matter of doubt. But there can be no doubt that it is due to an existing public sentiment, and that the tendency will continue and increase. It can not be successfully resisted and opposition will only intensify it. Railway officials can only successfully meet it by such enlightened action as shall make it superfluous and altogether unnecessary. The mechanical officers of railways have been engaged in this work of improvement for years, with manifestly great results in certain directions. To a certain extent they have been hindered and embarrassed by the lack of coöperation on the part of those superiors, whom financial considerations are the only things which can influence. The requirements of the law may make themselves felt by boards of directors who are not inclined to listen to the arguments of those in charge of their mechanical departments. It may thus prove that properly directed legislative action will overcome existing obstacles, and really give an impetus to mechanical improvement, by clearing the way. If this be true, it is the part of wisdom not to antagonize the action of our legislators, but to endeavor to direct it into proper channels; and to place in their hands the most complete and reliable information on the topics which they are investigating.

CAR-INSPECTION.

THE conditions under which cars are exchanged from one road to another, though usually supposed to be settled by the rules, are actually in a most unsettled and unsatisfactory state to all concerned. Those who interpret them in a lax manner are no better satisfied than those who wish to apply them with the most rigid interpretation. Almost every car-builder sees his road subjected to unnecessary expense, delays and annoyances which are traceable in various ways to the exchange system and its abuses. Theoretically the exchange of cars under the rules is perfectly fair, and should be attended with no difficulties.

Regular running repairs are made by the roads on which the car happens to be when they become necessary, while the wheels are supplied at the expense of the owner, at a specified rate. This perfectly fair and simple method of conducting the interchange of cars is no longer possible. The rules which appear to cover all cases no longer do so. If they are enforced, as they frequently are, the penalty always falls on the innocent party. And what is of even more importance than the injustice, the traffic is interrupted and general managers have to interfere, and, at the risk of accident, forward defective cars over their roads. Not a few of the evils of car interchange arise from the diversity of opinion among car-inspectors. There are very few points at which there is a uniformity of practice, and it was at one time hoped that joint inspection would, to a great extent, remedy the evils of the system.

While this brought about a great improvement, there were many things much too deep to be reached by any convention of car-builders. The officers of the roads appear to be ignorant of the evils which have grown up under the system, and of the enormous expense which the abuses entail. The almost universal effort to get materials and supplies at the lowest possible figures, regardless of quality, has produced a result which, to say the least, was little foreseen by the purchasing agents or superintendents.

It has been repeatedly stated by persons connected with roads owning line-cars that their true policy in purchasing for the lines was to buy the cheapest cars which could be obtained, regardless of pattern, workmanship, strength or durability. This is a practical recognition of the fact that the cars are on foreign roads for the greater portion of the time, that the running repairs while at home are but a small percentage of the total which they require, and that of the actual repairing the owner pays for a small share.

The saving in first cost effected by the cheap and shoddy cars is a very large one. On a contribution of 500 cars to a line a saving of $50 per car represents $25,000. On foreign roads the repairs are made according to the rules. Cheap wheels are replaced by others which are good, at the standard price. Running repairs are made by the roads on which the cars happen to be without cost to the owners, even though these are many times greater than those of an honestly-built car. So great has the evil of poor wheels become, that some roads have seriously considered the proposition to buy the cheap $5.50 wheels for the purpose of replacing others of the same kind under foreign cars. This, however, does not meet

the case entirely. The owner of the cheap car saves the trouble and delay of renewing the wheels, and no small portion of the actual cost of running repairs, in addition to the interest on the capital which he would have otherwise expended.

In one sense the inspection, as at present carried out, is a failure.

The road which is dishonest or careless throws a heavy burden upon all roads with which its connnects. And unfortunately these roads have no means of retaliation. The same is true of roads maintaining an absurdly fine inspection.

By means of it they throw the bulk of repairs upon all roads with which they make connections. In a through line from West to East, composed of a dozen roads or more, there will be found a great variety of policy and practice in car repairs. Rather more than half may be classed as disposed to be fair. They are willing to keep their rolling-stock in a condition which makes it safe to run. There will be three or four that propose to "skin" and make only such repairs as may be absolutely necessary to keep their cars on the road. Lastly there will be one or two roads which will insist on fine inspection. Upon any system of roads thus constituted most of the repairs will fall upon those roads which wish to keep their rolling-stock in a fair condition. In addition to repairing, these roads must also burden themselves with the cost of transferring a vast quantity of "time" and bulk freight. The way in which this happens is very simple.

A road which cares very little for the condition of its rolling-stock forwards a lot of grain East in cars which are not fit to run, or which need serious repairs. Easy inspectors pass them along until they have half completed their journey, and a road is reached which calls for a fair inspection. They are, of course, cut out of the train and the load transferred. This is done at the joint expense of the roads meeting at the point where the inspection was made. The car is returned to the owners for repairs and the two roads have to pay the cost of transferring the freight.

This is but a small item and would cause but little complaint in itself. The exasperating feature is, that in due course of time, the same car comes back with another load, with its defects increased by the round trip which it has made. In hundreds of cases after loads have been transferred and the cars returned to the owners for repairs, the same cars have come back loaded but without the repairs, and the loads have been transferred four times in succession. In some cases a hundred cars out of five hundred have been marked for a transfer of freight. As long as these cars can be kept on the tracks they are sent forward loaded, and the repairs are at last made by other roads in self-defence.

The actual owners of the cars are not always most at fault in these matters, since the broken cars may be loaded by others and sent East. Another class of car makes difficulty at the point of fine inspection. This embraces those that are perfectly safe to run, but have minor defects. Two or three roads have inspected and hauled them in perfectly good faith, as the defects are not of a character to make the car unsafe. Reaching the road where a particularly fine inspection is insisted upon, these are thrown out. It very frequently happens that the transfer of freight has to be made by the company over whose road the car has come.

The question of close inspection is one which has many sides. In theory a large majority of car-builders are in favor of it, as it tends to greater safety. As practiced at the present time, it is eminently unjust. Wheels are taken out for hair-cracks in the plate which have evidently existed since the wheel was cast.

We have seen many wheels of this kind, which, from the wear of the tread, it is safe to say have made long mileages. Wheels are thrown out for cracks so minute, that to make inspection certain the cars would have to be turned upside down and the work done in broad daylight. The plea for inspection of this kind is, that it is conducive to the safety of the roads. While close inspection does, to a great extent, prevent accident due to the failure of rolling-stock, this is not always the reason for its adoption. Card a car and it will pass unquestioned with a defect which would otherwise have thrown it out as dangerous. For example, a car with a nut off from a bolster truss-rod, would be thrown out as dangerous if it was found without a card. We recently saw a car carded for this defect which had been in service four months. Cars are cut out for "bad ends" when the defect shows as a mere insignificant crack. We have seen a flat-car loaded with rails cut out because the load had shifted eighteen inches in handling and the rails projected nearly as far as the draw-head. This entailed handling on the part of the delivering road which was entirely unnecessary.

A counterbore is often marked as a loose wheel, and two half-cracks in brackets have thrown a wheel out. Oil coming through a porous hub is often mistaken for a loose wheel. Sand-cracks as old as the wheel itself have also caused rejection. We have seen a pair of wheels taken from under a car for cracks, which under a magnifying glass proved to be the remains of fins which had been broken off. Sometimes inspection has been carried so far as to reject cars coming home for repairs. The objection to be found with the very close inspection is, that it is not carried far enough, and is one-sided, and cars would pass a night inspector when they would be thrown out in the daytime. If it is to be applied at all, it should be adopted by all the roads. It must be applied intelligently and should be consistent. If one wheel is to be scraped and searched with a glass for old hair-cracks, all wheels must be treated in the same manner.

If a cracked bolster is unsafe to run without a card, it is equally unsafe with one. The excuse for using or accepting the card is to secure the road taking the car from the expense of the repair. This is true, but it is also true that if a wheel fails the owner will have to replace it. There are plainly other reasons for such critical inspections in some directions, coupled with laxness in others. The wheels with the hair-cracks do not open suddenly nor break without warning. Attempts have been made to show that this was the case, but we think the demonstrations have not been satisfactory. To inspect cars in the manner which many car-builders advocate is out of the question at the present time. No road in the country has its rolling-stock in such a condition as to warrant it, for traffic would be suspended and at many points practically stopped.

That it is desirable to keep cars in perfect condition is not to be doubted. This must be accomplished, however,

by the roads undertaking a thorough system of repair of rolling-stock, and then insisting upon rigid inspection at all exchange points. The exchange of cars and the system of repairing foreign cars calls for the most careful investigation from the superintendents of the roads. And it would be well if the through lines could come to some mutual agreement in regard to the exchange and repairs of cars which they could maintain. If one or two roads take a car in good faith and haul it the whole length of their lines, it should not be thrown out, upon delivery, if the defect has not increased.

The judgment of two experienced car-builders should settle the question, and cars which they have taken should be accepted as against the opinions of another who demurs on the ground of minor and perhaps trivial defects.

While joint inspection has done much to facilitate the exchange of cars, it has not remedied all the evils of the system.

It seems that it should provide some arrangement at the inspecting points, by which A should be prevented from receiving a car intended for B, but which B will not receive from A after the latter has hauled it the whole length of his line. In such a case the intermediate road has to make the repairs, which should fall upon the owners. For example, a road delivering cars to a road in the State of Massachusetts, may take, through a joint inspector, cars without a step, or lacking some of the particulars called for by Massachusetts law. Before these cars can be delivered, the repairs must be made by the intermediate road. In justice, such cars should have been turned back to the owners, or steps, brakes, etc., should be put on and charged to the owners.

The plan strongly advocated by some of the oldest car-builders in the country is to charge repairs of all kinds to the owners of the cars. Under such an arrangement cars would not be turned back for trifling defects. They would have the needful repairs made, which would be charged to the owners. The only exceptions to this rule would be in cases when the hauling road damages the cars through accident or careless handling. On the mileage basis, this plan would work no hardship. It would, if adopted, revolutionize railway rolling-stock, and would gradually bring it into first-class condition by making it the interest of every road to keep up its own repairs.—W. E. P., in *National Car-Builder*.

Railways in Belgium.

As regards mileage in comparison with area, Belgium to-day enjoys the premier position among the nations of the world. Per 1,000 sq. kilom. (620 miles) there are 85 miles of railways in Belgium, 57 in Great Britain, 39 in Germany, 30 in France, and 10 in the United States. A recent official report shows that there were 3,038 kilom. belonging to the state and 1,255 kilom. belonging to the companies on Belgian territory. To this *reseau* should be added 1,637 kilom. of accessory lines and station extensions, which make 5,931 kilom. (3,685 miles) of line in Belgium proper. If, again, there be added 215 kilom., the length of line owned by the companies in foreign territory, the grand total is 6,146 kilom. (3,817 miles). When it is remembered, says the London (Eng.) *Official Railway Gazette*, that Belgium includes but 11,369 square miles, it will be seen that the growth of her railway system is remarkable. The network of lines, for all the world like a cobweb, is as close and intricate as in the English counties of Lancashire and Yorkshire, so proximate are the busy towns and villages—Ostend, Bruges, Ghent, Brussels, Termonde, Malines, Antwerp, Tournay, Courtray, Tourcoing, Quiveron, Jemappes, Mons, Charleroi, Namur, Louvain, Liege, Verviers, Ypres, Jurbise, Luxembourg, Nivelles—all within an area less than one-eighth that of Great Britain. The State railway, which extends to Ostend, the principal seaport, runs from Brussels to the frontier of France at twelve points, to the Prussian frontier at one point, to the Luxembourg frontier at two points, and to the Dutch frontier at two points. The rolling-stock is extensive. To work these lines the State has 1,570 locomotives, 13 stationary engines, 3,006 passenger-cars, 691 baggage, mail and express-cars, and also 41,384 goods vehicles. On the companies' lines there are 533 locomotives, 818 passenger-cars, 449 other vehicles, and 13,915 vehicles for the goods service.

Contributions to a National Museum Illustrating Steam-Transportation.

MR. J. E. WATKINS, of Camden, N. J., who has recently been appointed Honorary Curator of the section of Steam-Transportation (Railroads and Steamboats) in the United States National Museum, in connection with the Smithsonian Institution, is authorized by the Institution to treat in the interests of the National Museum with any persons who may be willing to aid in the development of this section, and to add to the collection already in the Museum, objects illustrative of the history and growth of this industry in the United States. Specimens thus acquired will be exhibited in the Museum in the name of the donor. Mr. Watson has issued the following circular:

"In order that the collection in connection with this section may be made as complete and creditable as possible your coöperation is earnestly requested.

"The Pennsylvania Railroad Company has already presented to the Museum, Locomotive No. 1 (of the Camden and Amboy Railroad Company), more familiarly known as the "John Bull," together with a section of the original track, laid with some stone blocks, etc., upon which this, the oldest engine on their system, ran. Many other valuable relics from other railroads have also been furnished.

"I shall be glad to receive information as to the whereabouts of parts of such locomotives, cars, steamboats, track, etc., as may be of historic value, together with authentic drawings of early railway appliances, also old tickets, old time-tables, systems of old baggage-checks, etc.

"A nation which contains within its borders over 120,000 miles of railway, representing a stock and bonded capital of over 7,000,000,000 of dollars, should be zealous to preserve the history of the efforts of the pioneers in railway construction and equipment, which, during the last half-century, have had such an immense influence upon our growth and the development of our civilization.

"With this end in view the authorities of the National Museum have organized this section, by which they hope to perpetuate the history of the birth and development of

the American railway and steamboat, as well as to add an interesting and instructive feature to the museum, which is annually visited by between two hundred and three hundred thousand persons, hailing from every State and Territory in the Union, as well as from almost every nation."

English and American Railway Speed.

So many "Englishmen" have written to the New York *World* criticising its statements concerning the speed of English railway-trains, and asserting that their Irishmen, Scotchmen and Dutchmen averaged fifty miles an hour—some claiming a mile a minute—that a recent issue of that journal showed the relative speed of American and English trains, the actual time being taken from the official time-tables. The average speed of the "Flying Dutchman" is 36 miles per hour from the start at Paddington station at 11:45 A. M. to the finish at Penzance, 325¾ miles. From London to Exeter, 193¾ miles in 4¼ hours, it averages 45½ miles per hour, but from Exeter to Land's End it is only an "accommodation." The "Flying Scotsman" leaves the King's Cross at 10 A. M. and runs into Waverly station, Edinburgh, 396½ miles, at 7 P. M., an average speed of 44 miles per hour. Its first dash is from London to Grantham, 105 miles. Its second dash is from Grantham to York, 84 miles. The 139 miles are run in 3 hours and 55 minutes, an average of 48 miles an hour. After this spurt its speed drops to 40 miles per hour, taking 5 hours and 5 minutes for the remaining 207¼ miles from York to Edinburgh. The "Wild Irishman" averages only 40½ miles per hour for its short run. A train runs on the London and Brighton 50 miles in 1 hour and 10 minutes, or 43 miles an hour. The 400 miles at 44 of the "Scotsman" is not only inferior as a feat to the 1,000-mile run at 41 between New York and Chicago, but inferior to the Philadelphia express, which leaves Jersey City at 4:10 P. M. and reaches the Quaker City at 5:55 P. M.—90 miles in 105 minutes, or 51½ miles per hour. Short dashes at high rates of speed are common on American roads, and stories can be told by American locomotive engineers (when not under oath) that would make the hair of any one of their British brethren stand on end.

Proposed Tunnel from the Canadian Mail Line to Prince Edward's Island.

As one of the terms upon which Prince Edward's Island entered the Dominion, the Canadian government were to keep up a continuous communication between mainland and island, Winter and Summer. This part of the union the government has failed to carry out, and the British government has been appealed to. Senator Howland believes he has solved the difficulty, and has submitted to the Senate, plans and profiles of a scheme by which steam communication may be carried on all the year round by a system of tunneling such as now runs under the Clyde, Severn and Thames, and which has been favorably reported upon by Vernon Smith, C. E., well known in engineering circles in America and Great Britain. The total distance from Cape Tormentine to Cape Traverse, the two terminal points, is eight-and-a-half miles. Between these two points are the Straits of Northumberland. It is proposed to run a tunnel composed of metal cylinders three-eights of an inch thick, 15 feet in diameter, lined with concrete two-and-a-half feet thick, giving a clear passageway at 10 feet, through which cars may be drawn by fireless engines; also to run piers out from the mainland on the New Brunswick side 10,000 feet, and from the Prince Edward's side 4,000 feet. To reach the bottom of the straits, which at the ends of these piers is 20 feet below water level, a cylinder will run down a gradual incline. Ventilation will be secured from a shaft sunk about half way across the straits, at which point the water is 90 feet deep.

Another Trans-Alpine Railway.

THE Arlberg Railway is scarcely opened for traffic when a new project for piercing another chain of the Alps is brought forward. The scheme applies to the Luckmanier, which, situated between the Upper Rhine valley and the basis of the Lake Tessin or Langensee, is not expected to offer any serious engineering difficulties. The railway would have to cross only one watershed, that of the Luckmanier (or, more correctly, the Greina), without having to surmount, as in the case of other Alpine railways, secondary watersheds. The length of railway proposed to be constructed, and joining Chur and Biasca, would be sixty-one miles. Its cost is estimated at between £4,000,000 and £5,000,000, of which between £3,000,000 and £3,500,000 would have to be expended upon the construction of a tunnel (thirteen miles long) between Surheim, near Dissentis, and Olivone, near Biasca. The countries most interested in the construction of the railway are, next to Switzerland, Bavaria and Central and Eastern Germany and Italy. It is urged in favor of the project that the St. Gotthard Railway has not answered the expectations formed of it, and could never do so, not having been constructed as a means of cheap communication and for heavy traffic, which, it is supposed, the promoters of the new scheme intend their railway to be.

Crude Petroleum as Fuel.

MR. A. J. STEVENS, general master mechanic of the Central Pacific Railroad, has devised a method of burning crude petroleum which he uses in the furnaces of steamers belonging to the road and for the stationary boilers in the shops. A heavy brick arch, not unlike the ordinary locomotive fire-box arch, is built in the furnace and the grate is covered deeply with a bedding of broken fire-brick. The petroleum is injected into the space between the arch and bed of broken brick, where it becomes gaseous, and meeting a supply of air, admitted by the proper appliances, is consumed. Two steam-jets, resembling injector-nozzles, force the petroleum into the furnace through the back of the shell. All the details for regulating the supply of combustibles and air are admirably arranged.

Respecting the apparatus Mr. Stevens writes the *Railroad Gazette*: "The apparatus works first rate. We are running our large ferry boat *Solano*, probably the largest boat of the kind in the world, and other steamers successfully with the fuel burned in this way. We are burning refuse or residuum petroleum, and we have not experi-

enced the slightest difficulty in keeping up steam, in fact we have much more steam now from the boilers than when we were burning coal. I do not know that to you there is anything particularly new in my arrangement, but I have never seen anything of the kind, and it seems to me that this apparatus is about what is required. We find the oil about 50 per cent. cheaper than coal. We can get up steam on a boiler with cold water in about thirty minutes, and the facility with which the oil is handled for fire makes the use of this kind of fuel very desirable on steamers. The fire can be entirely stopped or lighted in all the boilers in a few seconds."

New Prussian Railways.

THE Prussian Diet has been asked for grants for the extension and completion of the network of the State railways, to the extent of 60,700,000 marks (£3,035,000). Of this sum, 49,484,000 marks (£3,474,200) are required for the construction of fourteen new lines, of a total length of 587.4 kilometers (365 miles), and the balance for the completion of existing railways. Amongst the projected new roads, there are two main roads of a total length of 44.7 kilometers (28 miles), the cost of construction of which is estimated at 104,030 marks (£5,202) per kilometer, or £7,174 per mile, including the purchase of land; and twelve branch lines, of a total length of 542.7 kilometers (337 miles). The purchase price of land for the latter averages 5,650 marks, the cost of construction 68,000 marks per kilometer (£389 and £4,692 per mile respectively).

The End of the Suakim-Berber Railway.

THE building of the military railway from Suakim to Berber has been given up, on account of the abandonment of military operation in the Soudan. Eighteen acres of land adjoining Woolwich arsenal have been hired by the government for the purpose of storing the Suakim-Berber Railway plant, which is on its way back to England in thirty-two steam-vessels which are ordered to the Arsenal to discharge their cargoes. To facilitate the removal of the plant, a broad-gauge line is being constructed from the pier to the place of storage. The working of this line, which is about two miles long, presents a novel appearance, in consequence of the locomotives, carriages, stations, ticket-offices, etc., being painted with the words "Suakim-Berber Railway."

Locomotive Works in the United States.

THE principal locomotive works in the United States are as follows: 2 in Taunton, Mass.; 1 in Boston; 1 in Providence; 1 in Portland; 1 in Manchester, N. H.; 1 in Philadelphia; 3 in Paterson, N. J.; 1 in Pittsburgh, and 1 in Schenectady. The works in Philadelphia are the largest in the world, and are capable of producing 1½ to 2 locomotives per day. The works in Boston can turn out about 20 per month when running full. All the locomotive builders in this country are now running on short time. In addition to the works above named, many of the railways have shops of their own at which they occasionally build a locomotive to keep their men employed when no repairs are in progress. Prices of locomotives are only half what they were three or four years ago. A large freight or passenger-engine of the first class can be bought to-day for $6,500, againt $13,000 in 1881, and this would seem an excellent time to buy. The life of a locomotive varies from half-an-hour to a third of a century, but the average is probably fourteen or fifteen years. Some New England roads have engines twenty-five or thirty years in use for light work. The weight of a full-sized locomotive of the present day, with two pairs of trucks and two pairs of driving-wheels, is forty to fifty tons, and the size of the cylinder is 18x22 inches.

The Fate of an English Car in America.

TWENTY years ago, before drawing-room cars were introduced, an English compartment coach, elegantly decorated for those days, was built and run for a time on the steamboat train between Boston and Stonington. But it was never very popular. Americans do not care for that privacy which so many Englishmen insist upon, and they decidedly object to being locked up in a compartment, either alone or in company with one or two others who may be strangers. And so this palace-car of those days was soon taken off and was forgotten. But all these years it has been stored away somewhere by the Stonington Railroad, and at last it has been brought out, taken to Oakland Beach and converted into a café.

Cross-Ties on French Railways.

FROM the returns of the six great companies in France for the five years 1878-82, it appears that the average annual consumption of cross-ties amounted (on 12,720 miles average length of line, or 18,660 miles of single track) to 147 ties per mile of single track. Cross-ties of oak are the most common, constituting two-thirds of the whole number; beech constitutes one-fifth; pine and pitch-pine, about one-ninth; and lastly, fir, little more than 1 per cent. If an allowance of 25 per cent. of the total length of single track be made for sidings, the total amounts to 23,325 miles, and the consumption to only 118 ties per mile. The annual rate of consumption varies with the kind of wood used, but the average annual cost is approximately uniform at $145 per mile.

Iron cross-ties, which have been so extensively introduced in Germany and, to a small extent, in England, are as yet wholly in the experimental stage in France.

Death of Another "Oldest Engineer."

"UNCLE GAD" LYMAN, an old locomotive engineer, died in New York City last month, and it is asserted by his brother engineers, that he was the oldest locomotive engineer, not only in the United States, but in the world. His first handling of the throttle on a locomotive-engine was in 1839, on the Camden and Amboy Railroad. He was employed by the Rogers Locomotive Works, at Paterson, N. J., to take out engines. At the opening of the road to Binghamton he ran the special-train which took President Fillmore and his Cabinet to Washington. He worked on the Erie road for seven years, and left it to run an express-train on the New York Central. At the

commencement of the war of the rebellion he was appointed first engineer on the gunboat *Neptune*, and in August, 1865, received an honorable discharge. He was next employed on the New York and Harlem Railroad, where he had been ever since. Two years ago, in consideration of long and faithful service, he was assigned to the Port Morris branch for life, to do as he pleased. In all his experience of sixty years of engineering he never had an accident, and was laid up by sickness only three weeks. He was a member of the Brotherhood of Engineers from its conception, and up to his death was the chaplain of his lodge, 105.

Tie-Spacing.

WE think, says the *Journal of Railway Appliances*, that the time has come for seriously considering the question of tie-spacing, with a view of seeing whether or not the number of ties per mile could be decreased, with advantage to both the permanent way and the rolling-stock. We think that putting 3,000 ties per mile, or even only 2,640, is far too close work; that the rails should have more vertical stiffness and require less frequent support. Of course, this opinion will be regarded, at first, as nonsense, then as heresy, then as somewhat in advance of the times, and then it will be discussed, with due consideration. Within ten years the number of ties per mile in the track of our best new lines for high speed, will be reduced to below 2,500, and within twenty years to 2,000 or less.

Surface Crossing in England.

LEVEL crossing of railways by the highways are very rarely in use on English lines. The rails go over or under the public roads as a general thing. Where the crossing at grades does exist, English railway laws and customs demand the use of a gate worked in connection with the signal-box. A car-driver run over and badly injured at one of these level crossings, which was not provided with the usual gate, was awarded heavy damages, though it was clearly proved that the whistle was duly sounded, the judge ruling that the mere fact of whistling by an approaching train was entirely illusionary—that such whistling did not constitute necessary precaution. More in England than here, are the public protected by law and custom against "railway dangers."

Railways in Palestine.

MODERN railways are about to invade the Holy Land in several directions. Turkish capitalists have obtained concessions, and will build lines immediately from Alexandretta to Alleppo, along the bank of the Euphrates, and eventually to Damascus. The aim is to connect the Syrian sea with the river Euphrates, one of the most important highways of Asiatic trade.

A New Railway in Russia.

RUSSIA is about to begin a second railway between the Black sea and the Caspian, along the foot of the Caucasus on the north, while the existing railway is south of the mountains. Like the other Russian railways, it will be of five-foot gauge. The cost, with harbor improvements at Novorissik, is estimated at $9,500,000, or $55,000 per mile. The line will give an outlet to a productive grain country as well as to petroleum. The latter does not depend upon it wholly, as there is now a pine line sixty miles long leading from the wells to Novorissik. When built it will be possible to ride by rail all the way from the Atlantic to the Caspian sea.

Licensing Engineers and Conductors.

THE suggestion has been made that the various States should by law provide for the licensing of engineers and conductors, and that none but those who have received licenses be allowed to act as such. This would make an examination necessary and would tend to elevate these occupations more into a profession.

It is said that in Illinois a movement is progressing looking to the enactment of a law of this kind. If it has been found advisable or necessary in most States to require engineers in charge of steam-boilers to be lincensed, why, asks the *Railway Register*, should locomotive engineers be omitted? It is even more necessary for those in charge of passenger-trains to be competent men, than for those handling stationary engines in buildings.

The Largest Locomotive.

THERE is now nearly completed in the shops of the Baldwin Locomotive Works the largest locomotive ever built in America. It is intended for service on the Dom Pedro Segunda Railroad, of Brazil, and will probably be sent there this month. It is of the decapod class, with ten driving wheels, each 45 inches in diameter, and is mounted on a pony truck. The cylinders are 22 inches in diameter, with a 26-inch stroke. The boiler is 5 feet 4 inches in diameter, the fire-box 10 feet long and 43 inches wide, and the tender has a capacity for 3,500 gallons of water. The locomotive is designed for a gauge of 5 feet 3 inches, and will draw between 450 and 500 gross tons of cars and lading up a grading of 105 feet per mile. The wheels are so arranged that short curves can be rounded without difficulty.

SOME facts regarding railway freight are curious, as, for instance, it costs 4 cents per ton to unload tierces and 24 cents to unload light boxes. The chief reason is that one can be rolled while the other must be handled. Iron beams cost $2.05 per car to unload with tackle and $5.61 without. It costs 81 cents per car to unload rolls of leather, but $5.76 per car for loose sides.

THE new Forth Bridge, between North and South Queens Ferry, Scotland, approaches completion. It is a cantilever structure, 8,091 feet long, 150 feet high, and will cost $8,000,000. It has been nearly eight years building. Two thousand men are now employed upon it.

THE mileage of the Pennsylvania Railroad system is: Lines east of Pittsburgh, 2,178 miles; west of Pittsburgh, 2,629 miles; total, 4,707 miles. The American system having the greatest mileage is the Missouri Pacific, with 6,045 miles.

THE value of the rails imported into Italy in 1884 is officially returned at £573,046, as compared with £711,444 in 1883.

American Railroad Journal.

A MONTHLY MAGAZINE AND REVIEW.

(ESTABLISHED IN 1831.)

PUBLISHED AT No. 323 PEARL STREET, NEW YORK.

J. Bruen Miller, ... Editor.

Entered at the Post Office at New York City as Second-Class Mail Matter.

SUBSCRIPTION RATES.

Subscription, per annum, Postage prepaid $3 00
Single copies 25

ADVERTISING RATES.

Space (3¼ in. wide).	1 Mo.	3 Mos.	6 Mos.	12 Mos.
1 inch	$4.00	$10.00	$17.00	$31.00
¼ col. (or ⅛ page)	9.00	22.00	40.00	70.00
½ col. (or ¼ page)	15.00	40.00	70.00	120.00
1 col. (or ½ page)	26.00	72.00	130.00	235.00
1 page	48.00	115.00	210.00	400.00

For inside of covers, add 25 per cent.; for outside of back cover, add 50 per cent.; no advertisements will be taken for title-page.

The above terms are *net*, and for three months, six months or yearly contracts, are payable quarterly. Contracts for less time are payable after receipt of first number containing the advertisement.

MR. FREDERIC ALGAR, Nos. 11 and 12 Clements Lane, Lombard Street, London, E. C., England, is the authorized European Agent for the JOURNAL.

NEW YORK, JULY, 1885.

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CONTRIBUTIONS.

(*Written for the American Railroad Journal.*)

EDITORIALS.

MISCELLANEOUS AND SELECTED.

STREET-RAILWAYS.

NEW INVENTIONS.

THE ETHICS OF STRIKES.

THE pusillanimity of the West Division Street-Railroad Company, of Chicago, in dealing with the strike upon its road may be far-reaching in its disastrous effects. No earthly excuse can be offered by the Company for its cowardly surrender to the insolent demands of its employés, and the promised discharge of several of its capable officials at the word of a set of unreasoning road-hands, establishes a dangerous precedent.

In the question of strikes there is much to be said on both sides. The right to strike for higher wages is an inalienable right of the workingman in every capacity. To some extent, it is his only defence against the corrupt use of wealth and the grasping tendency of monopolistic organizations. If a railway underpays its men and requires of them more labor than it is willing to pay for, we say amen to an honest strike for higher wages or better treatment. But there is an honest strike and there is a riotous strike. The honest striker will, in concert with his fellow employés, leave work at a given signal and until a settlement is reached use all lawful means to coerce his employers. He will endeavor, and properly, to dissuade all other men from taking the position he left. He will endeavor to paralyze the business of his former employers through its entire cessation. This much he can do and do it lawfully. Doubtless, there are many capitalists who deem even this power to great a concession to labor, and would see it curtailed; but, thank God, the right of a man to set his own price upon his own work and to exercise his powers of persuasion to make others refuse to work at a smaller price, is still undisputed.

But there the power of an honest striker ends. The slightest attempt to injure the property of his former employer is a crime for which he should be made to suffer. The slightest attempt to prevent others from accepting the work he rejects, by threats, intimidation or personal violence, is an offence that should be punished with the utmost rigor. And yet intelligent men fail to comprehend the difference between a lawful and a riotous strike. They know what they want and deem their wants just; and so thinking, any means by which their ends are reached are considered justifiable. That is the argument advanced, and that is the opinion engendered and fostered by demagogue mayors and governors who angle for the labor vote.

And the pity of it is that the daily press as well takes that view of the case, and any attempt on the part of civil authorities to suppress the lawlessness of strikers, is denominated an outrage on the laboring man who is beslobbered with praise and courted as a member of a particularly privileged class. The press is quick to denounce Mr. GOULD, or Mr. VANDERBILT, or Mr. Anybody whose wealth gives him prominence, whenever any transaction

is entered into by them savoring of monopolistic greed, but the laboring man is a being who can do no wrong.

In the case of the Chicago strike a number of men were discharged by the railway company, and it was alleged as a reason for their discharge, that they had been prominent in forcing a successful demand upon the road for increased wages to its employés. Granted that this be true. Granted, also, that the railway company did a mean and ungenerous act when it discharged a few men who, by reason of their superior intelligence, acted as the leaders and spokesmen of their fellows. Granted, still further, that the fellow employés of these discharged hands pursued the only honorable course open to them in refusing to work upon the road until their spokesmen had been reinstated. What follows? Did the strikers or their friends and sympathizers acquire proprietary rights in the property of the road by their action? By their withdrawal from the service of the company, did they acquire a controlling voice in the operation of the road they were doing their best to injure? And must it be accepted as a truth that the unemployed form a labor congress whose express prerogative it is to say whom capital shall and shall not employ? Such, it would seem, are the natural questions arising from the results of the strike, and to these questions the strikers have boldly answered Yes; an answer received with applause by the whining, servile press. The cars of the road were interrupted in their travel, derailed and damaged, and the substitutes, who through necessity or lack of other employment had accepted the vacant places of the strikers, were subjected to personal insult and injury. And yet, when a police captain very properly clubbed the heads of a score of riotous strikers and their disorderly friends, he was accused of "brutality" and his eminently commendable vigor is stigmatized as a "bloody outrage." And after maintaining a bold front for a few days the road backs down and the insolent strikers are taken back, and the obnoxious persons who caused the discharge of the alleged leaders are dismissed from the company's service, and everybody is calm and peaceful again, the company happy in the thought that it has given its employés the right to dictate the most outrageous terms in the full confidence of their being granted, and the employés happy—and with more reason—in the knowledge that they have bullied the company in utter defiance of law and order, that public sympathy was with them, and that the company has acknowledged their bossism and placed itself under a yoke forever.

For once—just for once—we would like to see a reverse of the picture. We would like to see a combination of tradesmen—grocers, bakers, butchers and clothiers—fix the prices upon the necessities of life and declare that for less than that price the necessities of life shall not be sold. We would like to see one of their calling, in disregard of their action, undersell them and obtain the bulk of patronage from the working classes. We would then like to see the band of striking tradesmen attack both the disobedient seller and the high-handed buyers who had the audacity, the first to sell at any price he chose, and the second to buy where they can buy cheapest—to attack them, burn and destroy their property, and inflict personal injury. In that case would the public press extend their sympathies to the poor tradesmen who are making an heroic endeavor to "fix" the price of necessities, and at the same time, but in a different fashion, "fix" those persons who disregard their attempt and endeavor to pursue the even tenor of their way regardless of combinations of the sort? Ah, no! The case would be very differently handled; but then, these tradesmen are not "workingmen" and have not the special privilege of doing as they please, and interfering with other people's business and dictating terms with lordly mien. It makes a great deal of difference whose ox is good. And yet the cases are precisely alike. The insolence and outrage of the tradesmen would not be one whit the greater than the insolence and outrage of the striker.

THE RECENT CONVENTIONS.

LAST month was conspicuous in railway annals as the period of numerous conventions of railway associations, prominent among which—preëminent we may say—were those of the Master Car-Builders' Association and the American Railway Master Mechanics' Association An abstract of the proceedings of these two conventions would be of little service to our readers, and would in no way do justice to the organizations. In fact, to comprehend the entire scope of action of these two associations, and of others similar in character yet perhaps not attracting quite so much attention, an examination of the printed minutes is necessary, and while we shall endeavor to print the reports and papers submitted and read at these conventions, we shall omit the recital of the detail work which in due time will be made public in the minutes.

But in alluding to the subject we feel compelled to pay a just tribute to the associations both as to the nature of the work they carry on and also to the clear-headed manner in which it is performed. Yearly the conventions have increased in importance, and yearly the members have endeavored to give them more of a scientific than a social character. It is impossible that one hundred men, practical, intelligent, and whose calling is identified with the subjects under consideration, can meet and spend three or four days in the discussion of problems intimately associated with their profession without the railway world being the gainer, and the only fault we find with such

associations is that there are not more of them. Every department of railway construction and operation, from the highest to the lowest, affords an opportunity for study, and the discussion of the problems connected therewith infallibly will yield good fruit. Every year, fortunately, sees an increase in the number of such associations, and every year a palpable benefit is derived from the ventilation of practical questions by practical railway men.

EDITORIAL NOTES.

THE International Railroad Conference will meet in Brussels next month, and the United States will be represented thereat. While as a scientific study the results of the conference will be awaited with interest, it is doubtful if it will be productive of practical results. Railway methods vary too much among nations to hope for uniformity, at least for many years, and there are operating causes tending to render the subject of railway management peculiar and individual to each country. The conference will consider a number of questions and, in fact, almost too many. Fewer topics of discussion would allow of greater deliberation and consequent definite conclusions.

* * *

THE approaching Novelties Exhibition of the Franklin Institute, will offer an excellent opportunity for the display of novel railway appliances, which opportunity should not be neglected. The time for holding the exhibition has been fixed from September 15th to October 31st, and the railway exhibits are expected to furnish one of the most interesting features of the display.

* * *

THE death of Senator EZRA MILLER, of New Jersey, removes from us one of the most successful of railway inventors. The Miller coupler has stood at the head of such devices almost since its invention, and it may be demoninated as the first patent car-coupler that achieved marked success. The inventor acquired a fortune through it and yet, such is the inconsistency of man, while in the New Jersey Legislature he was classed among its anti-railway members. Despite his skill as a railway inventor, Mr. MILLER could hardly be called a practical railway man for he was an earnest advocate of a bill to reduce railway fare to a uniform rate of abont one mill per mile. Nevertheless, it can be said with truth, that by the invention of his coupler he has done as much as any man of his time in the interests of railways and of the traveling public.

* * *

THE special newspaper-train of the *New York World* has accomplished the feat of running from New York to Boston in five hours, and it is bragging somewhat of the achievement. Undoubtedly this time is a great improvement over the regular schedule time between those points, but the distance is only 229 miles, making the average speed of the *World* special but a little over 49 miles per hour. We trust the enterprising *World* will not rest content with this speed. Let their train run the entire distance of 229 miles in 229 minutes, and there will be something to brag about.

* * *

WILL the Baltimore and Ohio absorb the Philadelphia and Reading and the latter's leased lines? This appears to be the great question at present in railway circles. Should such be the result of the Baltimore and Ohio's efforts to get into New York it will accomplish two ends. First, a lively rivalry will be opened with the Pennsylvania, and two roads will be taken out of financial embarrassment.

* * *

AND now it seems Mr. VANDERBILT is going to secure control of the West Shore, and another bankrupt road will be absorbed. The railway magnate has stigmatized the West Shore as a "common, miserable thief," presumably beeause it paralleled the New York Central, but, apparently, it was all right for Mr. VANDERBILT to parallel the Pennsylvania Central. Trifling inconsistencies of this sort are not worthy of much attention, however. They are too common in railway management.

* * *

AT last the State Park at Niagara Falls is opened and the tourist can feast his eyes upon the most superb of Nature's handiworks without being subjected to all the miseries of extortion. The Niagara hackmen, it is presumed, are doleful, for they will no longer share the proceeds derived from the species of financial phlebotomy practised at every nook and corner of the Falls, but as by this time they are—or ought to be—all millionaires we need not waste our pity on them.

AMONG numerous interesting United States Consular Reports received from Washington is one of peculiar value at this time. It is entitled "Cholera in Europe in 1884," and gives a full history of the spread of the disease last Summer through Italy and Southern France.

CASSEL'S & CO.'S *Magazine of Art* for August is an unusually attractive number and is beautifully illustrated. Among their forthcoming publications, Cassell & Co. announce Lieutenant Frederick Sahwatka's "Nimrod in the North."

Appletons' Railway Guide and the *Travelers' Official Guide* for July appear promptly, chronicling the latest changes in railway and steamboat time-tables.

Outing continues more and more to place itself in active competition with the great monthly magazines. Its August issue is deserving of especial praise.

THE Montreal *Daily Witness* has published in pamphlet form, with numerous illustrations, the full history of the Riel Rebellion.

Street-Railways.

American Street-Railway Association.

President.—Calvin A. Richards, President Metropolitan Railroad Company, Boston, Mass.

First Vice-President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

Second Vice-President.—Henry M. Watson, President Buffalo Street Railroad Company, Buffalo, N. Y.

Third Vice-President.—Edward Lusher, Secretary and Treasurer Montreal City Passenger Railway Co., Montreal, Canada.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fourth Annual Convention of the Association will meet in St. Louis, Mo., on October 21st, 1885.

STREET-RAILWAY INVENTION.

THE following has been sent us in good faith and we seize it as the text for an editorial sermon:

CHICAGO, July 1st, 1885.

Editor American Railroad Journal:

DEAR SIR.—I am an inventor and I would like to know in what way I could devote my energies to inventing appliances for street-railway use. Is there any particular improvement that street-railways need and have not been furnished with? Can you kindly suggest an entirely new street-railway device that is needed and yet has not been furnished? Hoping you will be able to give me some information that may be of use, I am.

Yours truly, B. M. C.

You ask if there is any entirely new device that street-railways need and have not yet been furnished with. We answer, yes. A great invention would be a car that would run itself without bothering with a motor of any kind. As yet no such invention has been furnished. Still again, a device for collecting the fares of passengers, stopping and starting the car, and ejecting boisterous persons and those who will not pay their fare, would be considerable of an improvement over the prosaic driver and conductor. Such an improvement has not yet been supplied. Still again, a device that would do away entirely with the use of rails would come in handy, as it were. No such device has been patented.

In other words, you approach the subject of street-railway invention tail foremost. Instead of seeking to improve old methods by inventing a new appliance, you "reach out for the infinite" and endeavor by one bold stroke to revolutionize street-railway operation in a previously indicated manner. Furthermore, you speak of being an inventor. We recognize no such profession and we spoke strongly to that effect in our last issue. You might as well call yourself an eater. A man eats when he is hungry, and he invents when he feels a need for an improvement, which need he is fortunately able to supply. There is no profession of invention.

Unfortunately you have approached the subject the wrong way. Doubtless there are a thousand improvements that can be made in street-railway devices, and we can name a number. There can be improvements in tractive power; in methods of heating and lighting; in brakes, in wheels, in rails, in the car itself; in devices for registering fares; in upholstery and decoration; in every department of street-railway construction and operation; but the only way for you to discover what is wanted is by a careful inspection of present defects, and then a careful application to overcome these defects in the simplest manner possible. No amount of ingenuity is going to help you if you assume that to produce a valuable street-railway invention you must produce something entirely new.

And you may console yourself with the reflection that you are not alone in attacking the subject of improvement, instead of courting it. Many street-railway managers seem actuated by the same spirit of reckless adventure, and before the actual needs of their roads have received attention, plunge into the concoction of theories that will revolutionize the business.

If you see any defect in the present methods employed by street-railways, set about finding a remedy and if you succeed you have got the best sort of invention. The field is a good one and a practical man has a chance to do a great deal in the way of improvement. We have indexed many features of street-railway operation that can be improved, and the way for you to improve them is to examine their defects. In the same way the truly progressive street-railway manager will first seek to perfect present methods before devising new ones. We are not overly conservative here in America, but we don't like "earthquake" improvements, and the less an improvement has that is new about it—its novelty being its sole merit—the more we are liable to appreciate it. This is a very homely truth that is as applicable to the street-railway manager as to our frieud the inventor.

THE Broadway Surface road is now in active operation and despite our anticipation it does not seem as if the traffic upon that thoroughfare has been impeded thereby, while the retirement of the omnibus has resulted in an decrease of noise and confusion along Broadway. Honestly we confess it, we were bitterly opposed to the construction of the road, but our ground of opposition has been proven untenable, and we cheerfully admit that it appears to be of public benefit and usefulness. But now that the ice has been broken and it is demonstrated that a surface road can be operated on Broadway without an entire paralysis of trade and commerce, can we not live in the hope of seeing cross-town roads in the lower part of the city? The large tract of the city below Walker street is divided by Broadway as by an impassable gulf, and the western and eastern sections are without means of intercommunication by street-railways. Apparently all that has prevented the construction of street-railways between the North and East river ferries has been the vexed

problem of crossing Broadway; but if a road can run through Broadway without detriment to its business interests, surely there seems to be no valid reason why several cannot cross it. At present there is active rivalry between the Fulton and Cortlandt Street Railroad Company and the Fulton, Wall and Cortlandt Street Railroad Company as to which shall have the privilege of constructing the first cross-town line in the lower part of the city. Arguments are now being made before the Board of Aldermen by representatives of the two companies, and the public have very little interest in the matter so long as one of the two is granted a franchise. The intended routes of the two roads are practically alike, and the construction of either would supply the city with a long-needed means of travel.

THE CABLE SYSTEM.

BY W. W. HANSCOM, M. E.

[Written for the AMERICAN RAILROAD JOURNAL.]

WHILE this subject is receiving earnest attention from engineers interested in a proper development of the system and such modifications as must necessarily be made in the details to adapt it to different localities and for different climates, it is not, perhaps, inappropriate to allude to some of the plans which are put forth with the laudable desire of overcoming known objections and disadvantages. In some cases a mistaken theory prompts the eradication of some anticipated disadvantages, and a provision for such contingencies as are supposed, but do not really occur, or if at all at such infrequent times as to place them out of the category of derangements of great importance.

It is not right to expect that a system of street-car traction which has come into some prominence within five or six years, should be so perfect in its development that, without any modifications, it is adapted to any locality, climate or condition of traffic. It is neither just nor proper to expect everything from it, nor to condemn it as having no good qualities by which it may, under reasonable conditions, be of public benefit, and a financial success to those who may invest in its securities.

This system has proved advantageous, beneficial and profitable in San Francisco, first over lines too steep for horses, and afterwards, where horses had been used, it proved a much cheaper power than animals, over such length of road that the distance traveled by each passenger carried was not excessive. It being understood that a cable road might be of such length that if all the passengers traveled the whole length for a uniform fare, the operating expenses would equal the receipts, whatever number of cars were used at practicable limits of intervals between trains.

A sufficient number of cable roads have been built and are being operated under a diversity of conditions, to enable us to form an intelligent estimate of the probable cost of construction and operation when the conditions under which they are to be constructed and their requirements in operation are known. I mean that the cost of a proper tube, with superstructure and street work, with cost of motive-power, cars, grips, cable, etc., may be as definitely stated as any railway structure which may be proposed for any particular locality.

Enthusiasts may insist that any street in any city is a proper place to put and operate a cable road; but the same judgment is necessary and the same discretion required as in locating and constructing a railway in any part of the country. Because a cable road is successful in one locality, it does not follow that it must be so in any other locality. It seems hardly necessary to make this assertion, but there is as much variation in the cost of construction of cable roads as there is in the construction of steam-railways; and also as much variation in the operating expenses as in steam-railways. The same rules will apply in the one case as in the other, and any one who attempts to contravene natural laws by forcing conditions, must and will fail in the undertaking.

Because a cable road has been so constructed that it freezes up in Winter, it does not follow that one cannot be constructed that will not freeze; in other words, if the tube of the cable road in Philadelphia has been so ill-constructed that it has not sufficient back-bone to resist the action of the frost, it does not follow that all similar tubes must do the same. The Chicago roads seem to have been operated through as severe a Winter as ever Philadelphia is likely to have, and no such results have occurred as in the latter city.

While, in some instances, we may expect failures to accomplish all that is to be desired; yet these failures will serve to educate those who may follow, and lead to a more intelligent and careful consideration of plans for projected cable roads before they are adopted.

There is a mean between those who favor indiscriminate construction of cable roads on every street of any city, and those who oppose their construction on any street and, in fact, oppose the system entirely. There is a mean between the two where wise people will step in and construct and operate cable roads not only to their own financial benefit, but to the benefit of the community who accept and pay for their services.

Cable roads do not need to be hurrahed nor manipulated into existence for the pecuniary benefit of stock operators, but their own advantages are their greatest elements of power in inducing capital to be invested, when a reasonable condition in the wants of the traffic is shown, and favorable conditions for the operation of them in such localities and streets where the inhabitants desire them, are presented to the consideration of competent engineers.

In the April number of the JOURNAL extracts are taken from newspapers, one being from the *N. Y. Evening Post*, which seems to have a prejudice against the system of cable roads, although it may have been engendered by the wholesale attempts to cover all possible streets in New York City with cable roads, whether the system was adapted to particular streets or not. Some of the objections advanced by the *Post* are not based on experience and have no value among those who are acquainted with the facts in the operation of cable roads.

The *Post* says that machinery is not as intelligent as horses are, and, therefore, machinery should not be used. We would naturally infer that intelligence to design and construct would be sufficient to operate, and that man, who

has the knowledge, experience and judgment to construct machinery, would have sufficient ability to operate and direct it, to start and stop; but, according to the *Post*, after man has built a railway and constructed the cars for it, only horses have sufficient intelligence to move the cars, as they have an instict which prevents them from running over anybody and will turn one side. But the car—does that, too, go on or instinctively stop under such circumstances? It would seem that animal instinct is placed superior to human reason and intelligence. All street-cars are stopped by the brake, whether they are moved by horses or steam-power, and the brake is controlled by human intelligence through the physical ability of man; and whether the horses do turn one side or not to prevent running over a person, the car would continue on its way until stopped by the brake or some obstruction.

If the *Post* admits the fallibility of the grip-man in applying the brake with celerity, then allow some fallibility and contributory negligence on the part of the person who gets in the way of a coming car, or makes a mis-step in attempting to get on or off a moving car.

The stopping of street-cars is done by the brake, and the method of operating the brake is susceptible of improvement as is the brake on ordinary railway-trains. Air-brakes have already been applied to cable-cars and their efficiency is increased in a similar ratio to that between hand and air-brakes on steam roads. Thus the grip-man can now have the control of a whole train, and the increased momentum, alluded to by the *Post*, is absorbed by the increased brake surface in contact with the wheels of every car whether there be only the grip-car or a train consisting of three or more cars.

The writer has applied air-brakes to cable-cars and dummy, and they have been found ample to stop and hold a train on a down grade of one in eight, or 660 feet to the mile, so that their ability is beyond question on a comparatively level street, such as many are in New York City.

Experience in San Francisco has taught drivers and pedestrians that the grip-men can handle the cars much more promptly with the cable and brake than where horses are used, and the drivers of trucks do not, in fact, give the cable-cars a wide berth as the car is under better control than any truck hauled by horses, notwithstanding the statement of the *Post*.

While fair criticisms are in order, the arguments in vogue in the early days of railways should not be employed, nor assertions made that are daily and hourly disproved. It is to be hoped that the cable system will be developed under intelligent and competent engineering ability, and not by scheming or manipulating stock-companies that may be formed; and that cable roads may be constructed and operated in such localities as are favorable, to the increased comfort and convenience of the traveling public.

Street-Car Motors.

EVERY day the demand for an acceptable street-car motor becomes more apparent, says the *American Machinist*. Against motors so far tried there have been more or less objections, but to the observer it hardly seems that any of them have been tried with very much persistency. Many objections to something so much of an innovation as the doing away with horses on street-cars, are simply prejudices which a reasonable amount of persistence would overcome. If it were not for the fact that it is so easy to fall back upon the use of horses, no doubt a motor entirely acceptable would have been found before this; but it seems to be easier to go back to the old method than to persevere in overcoming the difficulties that may be expected in the way of the application of any motor. There is a place for a motor that is just right, but the owners or officers of the street-roads have so far shown but little patience in their trial; they expect impossibilities in the way of something that shall be just right at the first trial. An electric motor for street-roads would seem to possess special advantages, but does not seem to receive much attention. The first successful motor for this purpose that is placed on the track will have an important start in the race. In the meantime, unless there is more activity in the matter, wire cable propulsion may be improved until the introduction of any motor will be more difficult than at present. Important improvements are believed to have been recently made in cable roads, and perhaps with others to be expected it may be found the most desirable means of operating surface roads. However this may be, it is reasonable to suppose that horses will not always be used for the purpose.

Failure of the Philadelphia Cable Road.

THE Philadelphia Cable road is constructed through twelve miles of the principal streets of the city, and has cost the projectors $600,000; but it is estimated that $1,250,000 more will be required to correct mistakes. When the iron conduits through which the cable passes were laid, iron rods were run through the stringers and bolted to the top of the conduits just below the slot where the grip passes down to the cable under the street. Every change of temperature has been found to affect the width of the slot and hinder the passage of the grip.

The Broadway Surface Road.

DURING the few weeks in which the Broadway Surface Road has been in operation the traffic has been very large, and the ultimate profit of the owners is assured. Some rather extravagant estimates as to the extent of these profits have been made, one being as high as $1,000,000 per annum, but with a fair discount for exaggeration it is evident that the owners of the road will realize handsomely upon their investment.

So far the operation of the road has not acted detrimentally on the street-traffic, and there have been no serious blockades as prophesied. On the contrary the cars seem to act as traffic-guides and there is less obstruction than formerly, while the abolition of the omnibus has greatly lessened the noise and confusion on New York's principal thoroughfare.

The new cars will shortly be placed upon the road, and they are promised to be handsomest street-cars in the city. They will be a few inches narrower in the body than the ordinary car to allow for a contraction of the space between the tracks.

Switches are being built in the road near the Post-office, which are intended to do away with the old

Bleecker street car-tracks through Crosby, Elm, and Centre streets and Park place, which will be abandoned entirely. The Bleecker street cars coming down will switch into Broadway at Bleecker street, and continuing down Broadway will swing around the Post-office apposite Ann street, and run up Park place to Beekman street, and through Beekman street to the East River. Going up town the Bleecker street cars will continue along the old route through Ann street, will switch into Broadway opposite the Astor House, and continue on up to the switch at Bleecker street, whence they will travel on the old tracks.

Trying a New Compressed-Air Car.

IN Astoria, one of the suburbs of Brooklyn, a trial was made a few days since of driving a street-car by compressed air, according to the system of Robert Hardie. The car was built by the John Stephenson Company, and fitted up with compressed-air chambers to run a small motor or engine on the front platform, the air-chambers being under the car and car-seats, and where-ever there was spare room. This capacity was said to be sufficient to run the car ten miles, the rate of motion being very efficiently controlled by an air-brake.

Electric Railway Progress.

ELECTRIC railways, which seem to be slow of introduction on this side of the Atlantic, according to the *Popular Science Monthly* are multiplying in Europe, and thus far they bear the test of continued use remarkably well. English papers bring us reports of six months' operation. of such a railway at Brighton. The mileage run by the cars amounted to 15,600 miles, and the number of passengers carried was about 200,000, or all that the car would accommodate for the greater part of the time. The dynamo is run by a gas engine, which has consumed 300,000 cubic feet of gas. The total cost of traction—interest and depreciation on engine, dynamo, and motor, cost of gas oil and attendance—has amounted to $3.85 per day 100 mile run, or less than four cents a mile. The car service has been stopped for only one day, through the tires of the wheels giving out owing to the heavy pressure of the holiday traffic; there being at the time no second car available. On the whole, this is a very satisfactory showing for a system which is as yet only in its infancy.

,A Fireless Street-Car Motor.

EXPERIMENTS have recently been made in New Orleans with a machine for street-railways, the motive-power of which is obtained by evaporating ammonia after liquefaction, and has met with success so far. It is to be put into actual practice shortly on one of the surface-roads of that city.

An Electric Railway Test.

PROFESSOR SHORT, of Denver University, gave another public test of his electric railway on June 1st, at Denver, Col. The track is an ellipse 300 feet around, with a grade at one point of 250 feet per mile. The car made 7,300 feet in twelve seconds, with ten passengers; a rate of about 17 miles per hour.

The "Grip" Applied to Electric Railways.

A GRIP system of electric railways is proposed, in which the electric conductor or conductors shall consist of rigid rails firmly affixed to insulating supports, in a trench similar to that of the cable roads. Connection is made with these rails by means of roller contacts in such a manner that in ascending a grade, pressure may be applied between the car and the rails so as to give the car a greater pulling capacity, the pressure taking the place of weight in a locomotive.

Popularity of Steam Tramways in London.

THE steam-engines on the North London tramways are in great favor with the public. As an instance of this, it may be mentioned that the takings in one day on the steam-cars amounted to just double those on the horse-cars, although running alternately on the same line.

STREET-RAILWAY NOTES.

LICENSE of incorporation has been issued to the Inter-Municipal Elevated Railway Company, of Chicago, the capital stock being $1,000,000. The charter of this road gives it a right to build from the center of Chicago to Hyde Park, Lake View, Ciero, Jefferson and Lake.

THE John Stephenson Company are building a number of new cars for the Brooklyn (N. Y.) City Railroad. They are also building cars for a number of American roads and also for Mexican roads, and for a street-railway in Lisbon, Portugal.

THE new owners of the West End and Atlanta street-railway of Chicago, are now figuring on the cost of an extension to Westview cemetery. It is highly probable that the line will be completed to the cemetery before fall opens.

STEAM-MOTORS, each weighing 3,500 pounds, have been adopted by the Street-Railroad Company of Concord, N. H. Each motor is calculated to pull one car and make a speed of fifteen miles an hour where permissible.

HON. G. W. ALLAN, president of the Kingston Road Tramway Co., of Toronto, Canada, has agreed to state a figure at which the company would be willing to sell out their rights and privileges to the city.

IT is stated that the cost of the iron work of the Brooklyn Elevated Railroad erected was 3.22 cents per pound. The lowest contracts on the New York roads was 3.4 cents.

THE Birmingham (Ala.,) Street Railroad Company are determined to extend their line to Oak Hill Cemetery, which will give them four miles of track to the city.

THE Atlantic Avenue Railroad Company, of Brooklyn, N. Y., intend building a stable for their new Bergen street line at a cost of $50,000.

THE rails of the street-railway at Leesburg, Fla., have been laid as far as the Grand Central Hotel from the Florida Southern depot.

THE Louisville (Ky.) City Railway Company have just completed ten miles of new road, and are having twenty-one new cars built.

A NEW street-railway has been built in Galveston, Texas, by the Gulf City Street-Railway and Real Estate Company.

New Inventions.

Sax's Car-Weel.

JOHN K. SAX, of Pittston, Pa., is the inventor of an improved car-wheel which is herewith illustrated and described. The object of the invention is to secure an effective union of the body portion and rim or tire, without expensive forgings in the construction of the latter, and also to avoid the objections incident to the employment of rigid wheels.

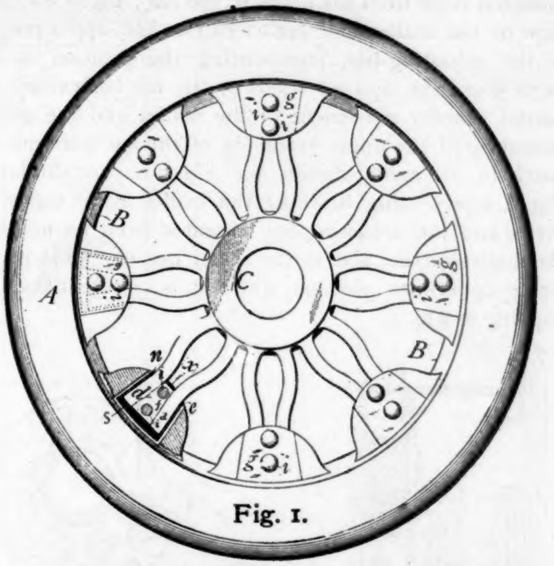


Fig. 1.

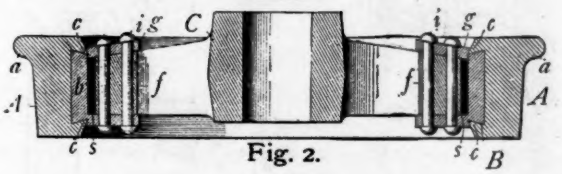


Fig. 2.

SAX'S CAR-WHEEL.

In the accompanying cuts, Fig. 1 is a side view of the improved wheel with parts detached and other parts in section, and illustrating one mode of constructing the body portion; Fig. 2 a transverse section of the wheel shown in Fig. 1; Fig. 3 a view showing a modification, and Fig. 4 a cross-section of Fig. 3.

The rim A, of the wheel may be of steel or iron, and may be cast or hammered or rolled into shape, and is provided at one outer edge with the usual flange *a*, and at the inner side with a continuous dovetailed recess or with a series of dovetailed recesses at equal distances apart, formed by parallel flanges *c c*, arranged at the opposite edges and with inclined inner faces, as shown. The inner rim B, consists of cast metal, which is cast in contact with the outer rim A, so that a portion or portions *b*, of the inner rim, will enter the recess or recesses in the outer rim, the two parts being fused together, and to this inner rim is detachably connected the body C, of the wheel.

In the manufacture of the wheel the outer rim or tire is first made, and then the mold in which to cast the inner rim is prepared, this mold being provided with an annular space to receive the outer rim, and with a space, or spaces or recesses corresponding to the form of the inner rim or section. The outer rim is then suitably heated, placed in proper position within the mold, which is then closed, and molten metal is poured into the mold, thereby casting the inner rim in direct contact with the outer rim, causing an intimate welding or fusion of the two together, so as to form, practically, but one part.

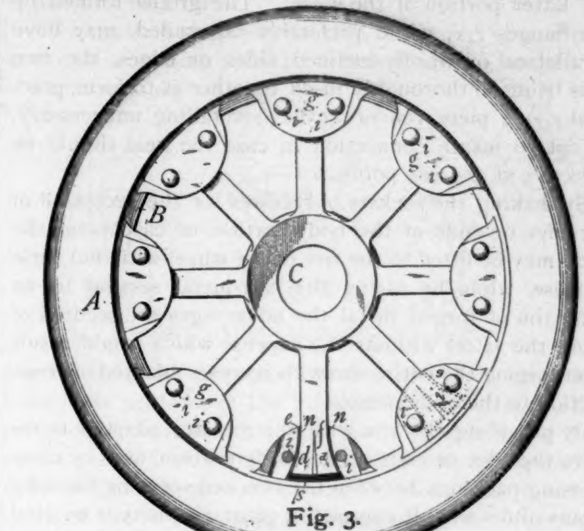


Fig. 3.

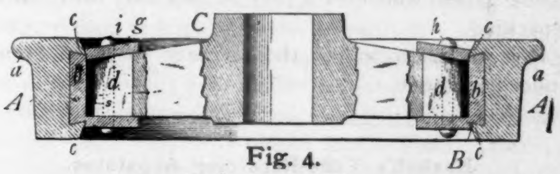


Fig. 4.

SAX'S CAR-WHEEL.

The inner rim is provided with recesses adapted to receive the outer portion of the body, and with cap-pieces between which and the inner rim such portions of the body are clamped. The body or center may be either a continuous plate or plates, or a hub provided with solid or divided spokes, as shown in Figs. 1 and 3. When the center is provided with spokes, the latter having flaring or expanded ends, the recesses or sockets *x*, in the inner rim are adapted to receive such ends, but are somewhat larger than the latter, and are covered by the cap-pieces *g*, which may be secured in position by bolts or rivets *i*.

When the spokes are solid, they are split to form two contiguous fingers *d d*; but when they are divided oı consist of two contiguous bars, as shown in Fig. 1, the ends of such bars form the fingers, which are bent outward to constitute the desired expanded ends. In either case there are recesses *e*, between the sides of the fingers or ends of the spokes and the adjacent sides of the recesses *x*, in which are inserted rubber or other elastic packings *n*, and wedges *f*, are driven between the fingers *d d*, so as to separate the latter and compress the packings *n*.

As the ends of the spokes do not extend to the ends of the recesses *x*, there are left spaces *s*, in which are inserted packings or fillings of rubber, oakum, wood, or other suitable material, after which the cap-pieces *g*, are applied, so as to clamp the ends of the body portion firmly to the inner rim.

The inner rim or section may consist of separate pieces, each fused at one point to the tire or outer rim; but it is preferable to make the inner rim of one continuous annular piece adapted to a continuous annular groove within the outer rim, the side flanges *c c*, of which afford wide bearings, resisting any thrust tending to displace laterally the outer rim or tire, and imparting greater strength to the latter portion of the wheel. The groove formed by the flanges *c c*, while preferably dovetailed, may have parallel or outwardly-inclined sides or edges, the two rims being so thoroughly fused together as to form, practically, one piece, rendering the dovetailing unnecessary, except to insure connection in case the weld should be defective at any one point.

By making the sockets or recesses for the reception of the edge or ends of the body portion, of cast-metal, the body may be fitted to the rim of the wheel with but little expense, while by fusing the cast-metal section to an outer rim of forged metal the advantages are secured of using the latter without the expense which would result from forging the entire rim with recesses adapted for connection to the body portion.

By providing the rim with the recesses adapted to receive the edge or ends of the body portion, and by compressing packings between the two and securing them by means of detachable cap-plates, great elasticity is secured and a secure connection of the parts, with ability to disconnect them whenever it may be necessary for repairs or repacking.

It is the intention of the inventor to grant licenses under his patent.

Haskell's Time-Recording Apparatus.

CHARLES S. HASKELL, of Philadelphia, Pa., is the inventor of a time-recording apparatus which is herewith illustrated and described. It is principally designed for registering the hour of arrival and departure of employés in factories and shops, and in this connection is applicable to railway use. An automatically-operating device is provided adapted to record both the name of the employé and the hour of his arrival at work. The apparatus is conveniently applied within the case of a clock, and is provided with a scroll of paper or kindred fabric, upon which the employé upon his arrival writes his name, and with a lever or handle which, after writing his name upon the scroll, the employé is required to move, with the result that, through suitable mechanism, the movement of the handle is communicated to a printing or embossing device, so as to effect the recording of the hour and minute of the throw of the handle in connection with the name written upon the scroll.

In the accompanying cuts, Fig. 1 is a side elevational and partially sectional view of the apparatus, the side of the casing being removed, exhibiting the type-disks and the devices for actuating the printing-mallet and for causing the travel of the scroll of paper; Fig. 2 a front elevational view of the same parts, the front face of the inclosing-casing being supposed removed; Fig. 3 a front elevational view of the apparatus complete, or as it appears when set up for use; Fig. 4 a rear elevational view of the same, the back of the casing being broken through, in order to exhibit the ratcheted wheel a^x, counterbalanced pivot pawl, and connecting-bar to the lever-escapement; Fig. 5 a detached elevational detail representing the normal position of the mallet and mallet-carrier, the actuating-bar, and the dog, when the above parts are at rest and before the handle is thrown to start them into action; Fig. 6 a similar view, indicating the position of the parts at the moment when the dog is at the limit of its upward movement, and at the moment when the spring of the actuating-bar has caused the engagement of the dog with the notch in the bar; Fig. 7 a similar view of the same parts, indicating, however, their position when the dog has about half completed its downward movement under the influence of its spring, and has almost unseated itself from the notch in the bar; Fig. 8 a similar view of the mallet and mallet-carrier and upper portion of the actuating-bar, representing the position of the parts when the upward travel of the bar has caused the partial upward movement of the mallet and the partial unseating of the upper extremity of the bar from out the notch in the mallet-carrier, and Fig. 9 a view similar to Fig. 8, representing, however, the mallet at the top of its throw and the actuating-bar unseated from its notch in the mallet-carrier, and in the act of moving up to its extreme uppermost position, which it is represented as occupying in Fig. 5.

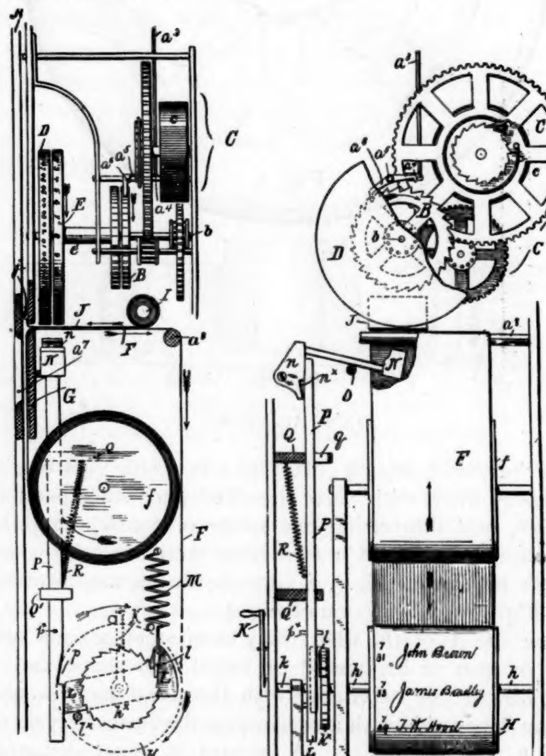


Fig. 1. Fig. 2.

HASKELL'S TIME-RECORDING APPARATUS.

A represents the inclosing-casing of the apparatus, in the upper portion of which is secured a clock-movement of any preferred description and provided with any preferred motor. A description of this movement, which may be employed in conjunction with a clock-face and hands *a*, as shown in Fig. 3, is unnecessary, except in so far as to say that the movement is provided with a ratcheted wheel a^x, provided with, for instance, thirty teeth, and connected with the clock-work in such manner as to

be caused to make one complete revolution every hour. This ratcheted wheel, which is exhibited in Fig. 4, revolves in the direction of the arrow upon it, and in so doing occasions the movement of a counterbalanced pivoted pawl a^2, to which is secured a connecting-bar a^3, which latter at its lower extremity is connected to a rocker-arm a^4, mounted upon a rock-shaft a^5, which is provided with a lever-escapement a^6, the pallets of which alternately, in the throw of the escapement under the influence of the rocker-arm, connecting-bar, and counterbalanced pawl, engage the teeth of a ratcheted escapement-wheel B, supported upon an arbor *b*, and so connected with a clock-

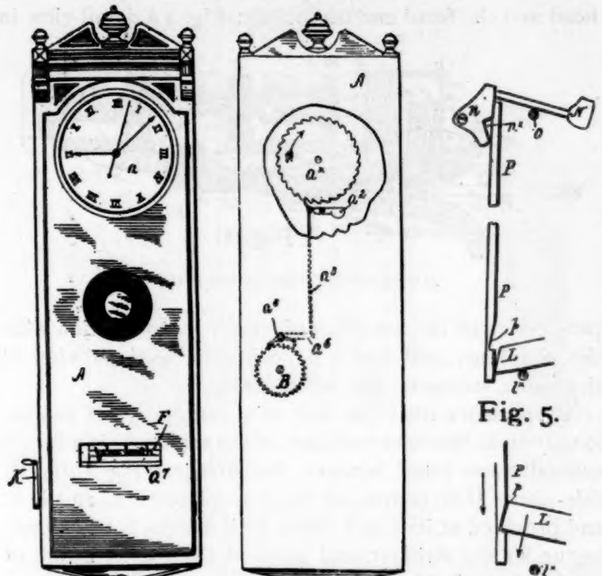


Fig. 3. Fig. 4. Fig. 5. Fig. 6.

HASKELL'S TIME-RECORDING APPARATUS.

work or other train of gearing C, actuated by a coiled band-spring *c*, or other motor, as to revolve once in an hour. The arbor *b*, which is journaled within the casing in a position at right angles to its face, is also equipped with a minute-disk D, the periphery of which is provided with numeral-types in a series of from 1 to 60. The operation of the lever-escapement permits of the actuation of the train of the gearing C, under the influence of its motive spring *c*, to occasion the rotation of the escapement-wheel and minute-disk once in an hour. Parallel with the minute-disk is an hour-disk, being a disk of the same diameter as the minute-disk, the peripheral face of which is also provided with numeral-types, numbered successively from 1 to 24. The hour-disk is mounted upon an arbor *e*, and so connected with the train as to be revolved ahead one peripheral space or number at the commencement of each hour.

The disks D and E, are simply printing-disks, and it is obvious that if a scroll of paper or other prepared material be pressed against a given point in the periphery of the disks simultaneously, and a printing-ribbon be interposed, the imprint of the numerals presenting at the points of contact will be impressed upon the scroll.

F is a scroll of paper, which is wound upon a paper-barrel *f*, housed in the casing, with its shaft parallel with the face thereof, in such manner that the scroll can be unwound from the barrel in the direction of the arrow in Fig. 1 on the barrel, and led upward parallel with and behind the face of the casing across what is a "writing-board" G, which latter is supported in the casing to the rear of a slot a^7, formed in the face of the casing.

The paper is led over the upper edge of the writing-board, and backward about a directing-roll a^8, and downward, and then about a winding-drum H, which is mounted upon a shaft *h*, and adapted to be actuated as explained hereafter.

I is a winding-shaft journaled in the casing, upon which is wound a printing-ribbon J, which is carried forward on

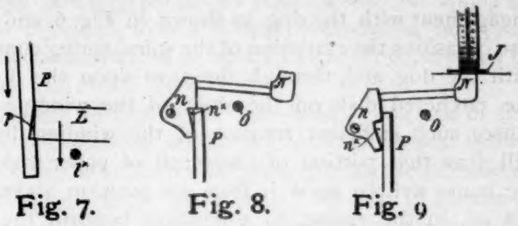


Fig. 7. Fig. 8. Fig. 9

HASKELL'S TIME-RECORDING APPARATUS.

top of the scroll of paper, and immediately beneath the lowermost portions of the minute and hour disks, and is secured by a suitable fastening *j*, with the casing. It is obvious that if the scroll of paper at a point beneath the disks be pressed upward against the disks, the numeral-types on the respective disks presenting at the lowermost points of their peripheries will be caused to leave their impress upon the scroll of paper by the action of the printing-ribbon in a manner well known.

K is a handle mounted exterior to the side of the casing upon a handle-shaft *k*, journaled in axial alignment with the shaft *h* of the winding-drum, and L is a dog mounted upon the inner extremity of the handle-shaft *k*, face to face with the ratcheted disk h^x. This dog is slightly angular at its front extremity, and at its rear extremity is provided with a dog-pawl *l*, which depends in such position as to be in engagement with the teeth of the ratcheted disk h^x. A spiral spring M, connected at one extremity with the casing at a point above the dog, is at its lower extremity connected with the dog, so that its ordinary tendency is to keep the dog in contact with the stop l^x, (Fig. 1,) fixed to the casing. N is a printing-mallet connected with a mallet-carrier *n*, pivoted within the casing. This mallet-carrier is provided with a notch n^x, for the upper extremity of the mallet-actuating bar. P is the mallet-actuating bar, it being a rod housed in bearings Q Q′, provided near its lower extremity with a notch *p*, and also provided with a stop-pin *p* , adapted to engage beneath the bearing Q′. R is a spiral spring connected with the upper bearing of the actuatingba-r, or the other fixed point of connection, and connected also with the actuating-bar, this spring being in its connection suspended at an angle such as to cause it to act upon the actuating-bar in two directions. In the normal set of the devices the bar occupies the position represented in Fig. 5 with respect to the notch n^x, in the mallet-carrier, while the dog occupies the position represented in Fig. 5 with respect to the notch *p*, in the actuating-bar. In this position of parts the mallet is down against a stop-pin O, and the forward extremity of the dog is also down against its stop-pin l^x, as represented in Figs. 1 and 5.

The operation of the mallet or the stroke of the same for the purpose of imprinting the types upon the type-

disks upon the scroll of paper, is occasioned by the rearward throw of the handle K, which the workman is directed to make upon his arrival, and after he has first written his name upon that portion of the scroll which presents through the slot in the front of the casing. After writing his name the throw of the handle occasions the throw of the dog from the position which it is represented as occupying in Fig. 5 up to that shown in Fig. 6, a movement which permits the spiral spring connected with the actuating-bar to throw the notch in the bar into engagement with the dog, as shown in Fig. 6, and which also occasions the extension of the spiral spring connected with the dog, and, through the pawl upon the dog and the ratcheted disk on the shaft of the winding-drum, causes such sufficient rotation of the winding-drum as will draw that portion of the scroll of paper which has the name written upon it from its position abreast the slot a^7, in the casing, to a position beneath the type-disks. The release of the handle will then permit the spring M, connected to the dog, to contract and deflect the dog, the pawl of which slips over the ratcheted disk, so as to be without influence upon the winding-drum, the deflection of which dog is accompanied by the downward throwing of the actuating-bar and the extension of the spring R, connected therewith, until such moment as the continued rotation of the dog has caused its unseating from out the notch p, in the actuating-bar, as shown in Fig. 7 and 5, whereupon the bar, which in its downward movement has become, by reason also of the influence of its spring R, engaged as to its upper extremity with the notch n^x in the mallet-carrier, is, under the influence of its spring R, caused to fly rapidly up and throw the mallet-carrier and mallet up, so as not only to occasion the printing of the paper with the numbers presenting upon the disks at points abreast the name written upon the scroll, which numbers record the then time of day, but also to occasion the unshipping of the upper extremity of the actuating-bar from the notch in the mallet-carrier, by reason of the altered position of the mallet-carrier, which necessarily brings to pass such result, and which which will be understood by a reference to Figs. 8, 9, and 5.

It will now be understood in what manner the spiral R, connected with the mallet-actuating bar, and which is, of course, of less energy than the spiral M, connected with the dog, operates in the first instance to draw the actuating-bar in such direction as to cause the engagement of its notch with the dog, and in the second instance to cause in the downward movement of the bar the engagement of its upper extremity within the notch in the mallet-carrier.

The play of the upper extremity of the mallet-actuating bar is permitted by providing the upper bearing Q, with a slotted opening g. It is obvious that if the printing-ribbon be dispensed with, the mallet will cause the embossing of the scroll by the types upon the disks.

The contrivances for actuating the mallet and shifting the scroll of paper may be modified by the employment of a pressing or pulling-button, instead of a handle, and a lever and link connection may be used to effect the movement of the mallet and the travel of the scroll. The device could also be as well made in a separate case and connected with the clock by an electric wire, so that in large factories there could be one at each entrance, while in railway shops it could be connected with the electric clock system.

Zimmerman's Car-Coupling.

CHRISTIAN H. ZIMMERMAN, of Burbank, O., is the inventor of a new car-coupling which is herewith illustrated and described. The invention is controlled jointly by the inventor and by Chas. W. Weiser, of the same place, to whom one-half of the patent-rights have been assigned.

In the accompanying cuts, Fig. 1 is a longitudinal vertical sectional view of the car-coupling; Fig. 2 a transverse vertical sectional view taken on the line $x\ x$ in Fig. 1; Fig. 3 a transverse vertical sectional view taken on the line $y\ y$ in Fig. 1; Fig. 4 a perspective view of the draw-head and the front end of the car; Fig. 5 a detail view in

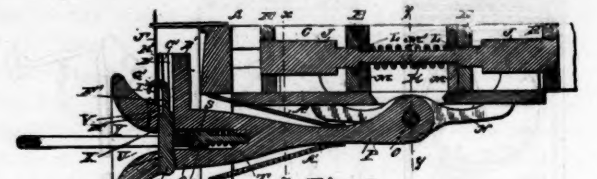


Fig. 1.

ZIMMERMAN'S CAR-COUPLING.

perspective of the coupling-pin used in connection with the coupling; and Fig. 6 a horizontal sectional view of the frame, stringers, and buffer-string.

A represents the front end of a car, and B B are the longitudinal beams or stringers of the same. C is a longitudinal frame fitted between the stringers, consisting of side-pieces D D, connected by cross-pieces E E, and F F, and provided at its lower edges with flanges G G, extending under the stringer, and secured thereto by means of vertical bolts H H.

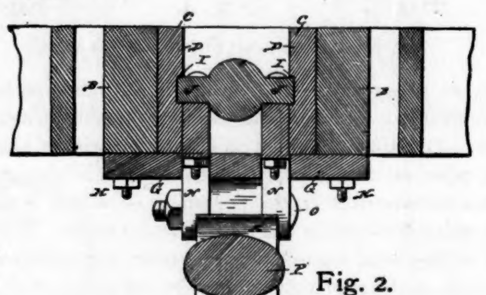


Fig. 2.

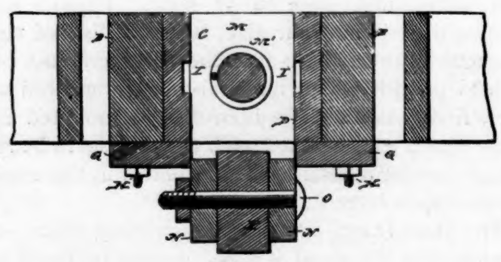


Fig. 3.

ZIMMERMAN'S CAR-COUPLING.

The inner sides of the frame-pieces D D, are provided with grooves I I, to accommodate a pair of slides J J, connected by a rod K, for the accommodation of which, as well as of the slides, suitable openings are provided in the cross-pieces of the frame. The rod K, is provided with shoulders L L, against which are fitted plates or washers M M, bearing against the inner sides of the cross-pieces

E E, of the frame; and upon the rod K, between the plates or washers, is coiled a strong spring M′, which in practice serves as a buffer-spring.

N N are a pair of longitudinal parallel hangers or brackets secured to the under sides of and connecting the slides J J, and provided with a central transverse pin or bolt O, forming a bearing for the rear end of the shank P, of the draw-head Q. The latter is provided with the longitudinal recess R, in which is fitted a sliding block S, adapted to be forced in a forward direction by the action of a suitably-arranged spring T, and having at its upper

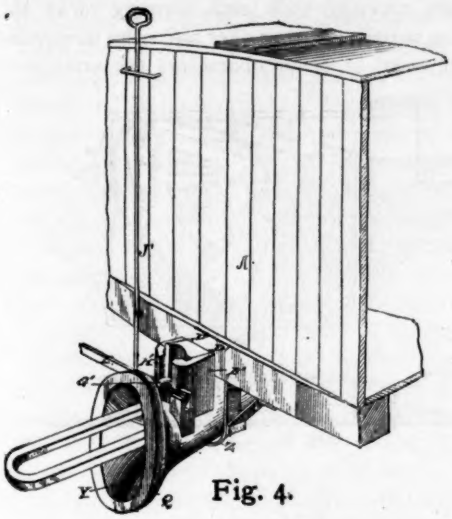


Fig. 4.

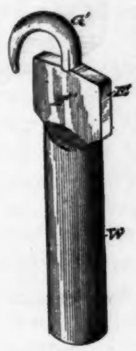


Fig. 5.

ZIMMERMAN'S CAR-COUPLING.

front edge a forwardly-extending plate U, adapted to extend under the upper vertical pin-hole V, and support the coupling-pin W, in position for coupling. A stop X, is arranged to prevent the sliding block from moving forward too far.

The mouth Y, of the draw-head is comparatively narrow, but of considerable height, and provided with beveled or slanting sides, top and bottom, for the purpose of enabling cars of unequal heights to be readily coupled without the use of crooked links. The shank P, of the draw-head is

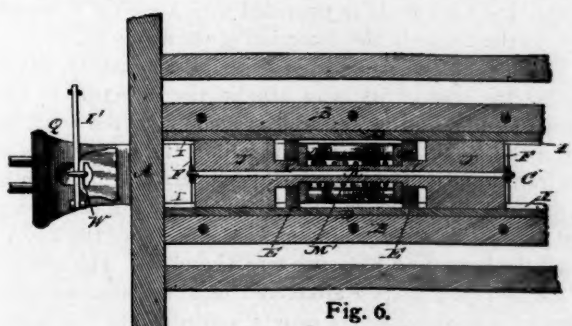


Fig. 6.

ZIMMERMAN'S CAR-COUPLING.

curved upward and hinged between the hangers N N, as already described, thus enabling the draw-heads of two cars of unequal height to swing, respectively, upward and downward when the cars come togethe , and thus adapt themselves to each other. In order to sustain the draw-head normally in a horizontal position, a pair of flat springs are bolted to the upper and under side of the draw-head, near the rear end of the latter, and, extending forward, bear, respectively, against the under side of the car and against a bail or bracket Z, bolted to the under side of the car and encircling the draw-head. These springs which are designated by letters A′ A′, also serve to impart the proper elasticity of motion.

The draw-head is provided with an upward-extending lug B′, provided with a pin-hole C′, registering with the pin-holes of the draw-head, and provided at the sides with vertical grooves D′, serving as guides for the flanges E′, extending laterally from the head of the pin F′. The latter is provided with a forwardly-extending hook G′, for the accommodation of which a slot H′, is provided in the front wall of the lug B′.

I′ is a lever pivoted to the draw-head at one side of the latter, and extending under the hook G′, so that it may be used to raise or lift the coupling-pin for the purpose of uncoupling the cars. Attached to the end or handle of this lever, is a rod J′, extending through suitable guides to the top of the car, so that the uncoupling may be performed by a brakeman stationed on the roof of the car.

The coupling devices are simple, certain in action, and easily manipulated, and the attachment of the draw-head to the car gives it a free and elastic vertically-swinging and longitudinally-sliding motion, which is useful and effective for the purpose described.

Pullman's Electric Bell-Cord for Railway-Trains.

SMITH C. PULLMAN, of Catskill, N. Y., is the inventor of a new electric bell-cord for use on railway-trains, that is herewith illustrated and described. The bell-cord couplings only will be shown in the cuts, as the application of the device is readily understood.

Fig. 1.

Fig. 2.

PULLMAN'S ELECTRIC BELL-CORD FOR RAILWAY-TRAINS.

In the accompanying cuts, Fig. 1 shows the couplings of the bell-cord when connected, and Fig. 2 the same couplings when disconnected.

On the cab of the locomotive is a switch by which the circuit may be opened when the engineer does not desire to hear the bell ring. The line-wires are insulated and are run in the bead of the moulding along the side of the car near the top, where they are out of the way and out of sight. At each end of each car are provided binding-posts which connect the line-wires and the push-buttons. From the binding-posts the line-wires extend through openings in the ends of the car over the door far enough to permit them to be coupled with the wires of the next cars. The projecting ends of the line-wires are connected to the improved coupling to form the circuit,

and the couplings are thus constructed: The body portions H, and two sides I I', of the couplings are of hard rubber. The seats J for the binding-posts J', are of brass, separated by the hard rubber. The body portion H, of the coupling is concave on each side near its forward end, and is then convexed [illegible] forms the point P. To each side of the body portion H, is secured a German-silver spring J^2, which is bent to conform to the outline of the forward portion of the body H. The springs J, and the sides I I', are secured in place by screws. The couplings are all alike in construction, so that the coupling can be effected at either end of the car. The cable consists of two wires, specially insulated, and run from the engine under the tank to its rear end. On the coaches the wires are covered with gutta-percha. When two couplings are shoved together, the hard rubber separates the springs, making two separate conductors. When the train breaks apart, the couplings pull apart, and the springs come together and close the circuit, which causes the vibrating bell on the engine to ring, and notifies the engineer that his train has parted. If the engineer does not want to hear the bell ringing until he has coupled up again, he can turn the crank of the two-point switch on the dead-pin, which opens the circuit, thus stopping the bell. The coupling on the rear end of the rear car can be shoved astride the cord to keep it open.

This system can be applied to all railway-cars without damaging the latter other than by boring eight small screw holes. It is inexpensive, reliable, and not subject to derangement. It is at present in experimental use on the Ulster and Delaware Railway, the New York, Susquehanna and Western and on the West Shore road, where it is giving satisfation. The inventor claims that the total expense of maintaining his system in use on a train of six cars, will not exceed fifty cents per year.

The device is now controlled by S. C. Pullman & Co., of Catskill, N. Y.

Stripe's Indicator-Lock.

HORACE G. STRIPE, of Omaha, Nebraska, is the inventor of a new and improved indicator-lock which is herewith illustrated and described. As here shown, the registering or indicating device is applied to a railway car-door lock, but it is similarly applicable to any form of lock.

In the accompanying cuts, Fig. 1 is a side view of the improved lock, the front plate being removed; Fig. 2 a longitudinal sectional elevation of the same on the line $x\ x\ x$ in Fig. 1; Figs. 3 and 4 show keys for the improved lock, and Fig. 5 is an end view of one of the keys.

The bolt A, is provided at its inner end with a notch A', adapted to receive the sliding latch-bolt B, which moves transversely to the bolt A. The end of the latch-bolt B, fits into the notch A', in the bolt A, and the latch-bolt B, rests upon a tumbler C, pivoted in the casing and adapted to swing toward and from that end through which the bolt A, passes, which tumbler is acted upon by a spring D, which presses it in the direction from the same end of the casing. The latch-bolt B, is provided in its under side with a downwardly-projecting stem E, which passes into a slot F, parallel with the axis of the tumbler, and provided with a transverse slot at each end. The latch-bolt B, is provided with a notch G, for receiving the bits of the key. In place of the above-described tumblers, any other tumblers of suitable construction can be used.

On the inner surface of the back of the casing an elbow-lever H, is pivoted by a pin H', at its angle, which lever is provided at the end of its short arm with an upwardly-projecting tooth J, having a beveled edge. On the end of the other arm of the lever H, a tooth is formed, which is adapted to rest against a shoulder *a*, formed on the free end of the tumbler C. On a pivot K, a series of frames L, are pivoted, which have curved edges, and parts of the curved edges are provided with teeth, forming racks M, and on the upper surfaces of the other parts the numerals from 0 to 9, inclusive, or other characters are arranged,

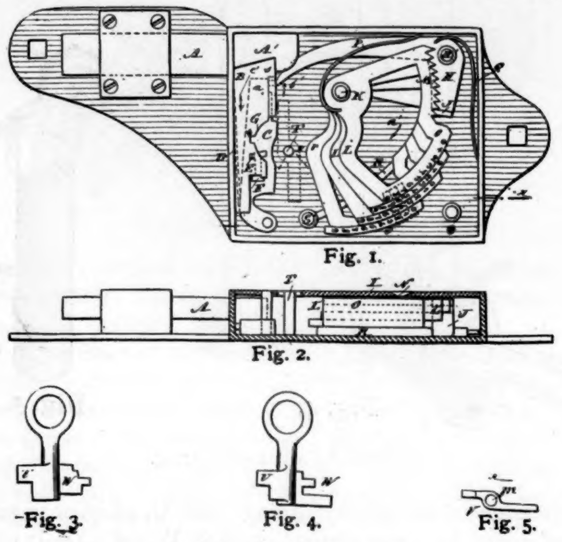


Fig. 1.

Fig. 2.

Fig. 3. Fig. 4. Fig. 5.

STRIPE'S INDICATOR-LOCK.

these numerals or other characters being arranged in segmental lines. The racks M, of the frame L, are arranged above each other, so that the ends of the teeth form vertical lines; but the parts O, carrying the numerals, are so arranged that their upper surfaces will be in the same plane, and the rows of numerals or other characters will be adjoining each other on parallel segmental lines. Each frame L, is provided with a spring P, which throws the frame in the direction of the arrow *a'*.

The elbow-lever H, is provided with a spring Q, which throws the end of its long arm in the direction of the arrow *b*. The bottom frame L, rests on a curved track R, and a check-pin S, is provided to limit the movements of the frames L, in the direction of the arrow *a'*. A pintle T, projects upward from the bottom or back of the casing and passes into the opening *m*, of the barrel of the key V.

All the keys used have two bits, U and W. The bits U, of the keys are shaped alike, and must be provided with more or less shoulders or offsets, according to the number of tumblers used with the latch-bolt B, and according to the configuration and shape of these tumblers and the arrangement of the same. The bits W, of the several keys are all different, for a purpose that will be shown.

The top plate I, of the lock-casing is provided with a slot N, the length of which is equal to the width of four (more or less) rows of numerals or characters on the parts O, this slot being so arranged that when the frames L, all rest against the stud or pin S, the numeral 0 of each row of numerals on the parts O, will appear in the

slot. Means are also provided for covering the slot N, with glass or any other transparent substance, which can be taken out or replaced when broken or destroyed without removing the lock.

The operation is as follows: If the key is inserted to draw the latch-bolt B, to permit moving the locking-bolt A, back or in the casing, the key is inserted, with the bit U, on top, and is then turned to the left. The bit then pushes back the tumbler C, so that the projection E, on the bottom of the latch-bolt B, will be at the bottom of the longitudinal slot F, and, then by further turning, the bit moves the bolt B, in the direction of the arrow c', and when the pin or projection E, on the bottom of the latch-bolt B, arrives at the lower end of the longitudinal slot F, the spring D, forces the tumblers outward, and the pin E, passes into the bottom transverse slot of the longitudinal slot F, thus locking the bolt and tumblers in place. If the bolt is to be locked after having been pushed into the casing, the latch-bolt B, must be moved upward. To do this the key is inserted in such a manner that the bit U, projects downward. When the key is turned, the bit U, first pushes back the tumbler, thereby disengaging the bolt, and then throws the bolt B, upward in the inverse direction of the arrow c', and causes its end to pass into the notch A', in the bolt A. By turning the key in such a manner that the bit U, can act on the tumbler C, and the bolt B, the bit W, is turned in such a manner as to act on the curved shoulders r, of one or more frames L, thereby swinging the frames L, in the inverse direction of the arrow a', a greater or less distance, according to the length of that part of the bit acting on each separate frame L. As the frames L, are moved in the inverse direction of the arrow a', at the same time that the bolt is thrown, the spring Q, of the lever H, moves the long arm of the angle-lever H, upward, thereby causing the tooth J, at the opposite end to move in the direction toward the racks M, and engage with the teeth of the same. After the bolt B, has been thrown, the frames L, are held in the different positions by the tooth J, the positions varying according to the length of the parts of the bit W, acting on the several frames. Different numbers or characters on each curved part O, of each frame L, will appear through the slot N, thus showing what key has been used to throw the bolt B, and thus lock the bolt A, in place. If any key is used to throw the bolt B, the key is inserted with the bit U, upward, as stated before, and turned to move the bolt B, downward. At the same time the bit W, of the key presses the frames L, slightly in the inverse direction of the arrow a', thereby causing the beveled teeth of the rack to force the tooth J, outward from the racks. By the time the tooth J, has been disengaged from the teeth of the racks M, the shoulder s, on the latch-bolt B, begins to act on the large arm of the angle-lever H, and moves it in the inverse direction of the arrow b', thereby disengaging the teeth of the racks entirely from the tooth J, and permitting the springs P, of the several frames L, to throw the frames in the direction of the arrow a', until all the frames rest against the stop-pin S.

For a switch-lock, the inventor claims the above-described device especially suitable, as it would thus show, in case of accident, who last locked the switch and, by a secondary device, it may also be shown what particular key was used to lock it.

Scott's Car-Axle Box.

JAMES O. SCOTT, of Tyler, Texas, has recently invented an improved axle-box for car-axles, which is herewith illustrated and described. It is the object of the inventor to provide an axle or oil-box for car-axles, so arranged and constructed that the lid or cap thereof will be automatically and securely held in position when closed, and also to provide an axle-box having a detachable cap, provided with inwardly projecting pins or trunnions upon its flanged ends, which run in grooves in the opposite walls of the box, in conjunction with inwardly-turned flanges upon the end flanges, whereby the cap is not only closely drawn against the open end of the box, but may also be raised and thrown over upon the top of the latter and retained in that position by its own gravity.

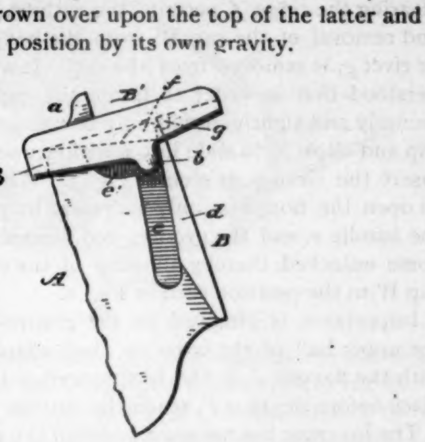
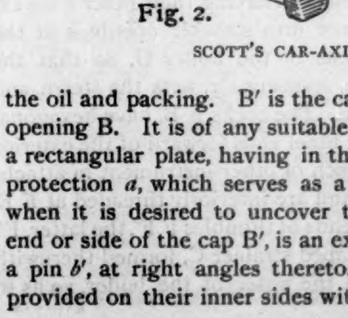


Fig. 1.

SCOTT'S CAR-AXLE BOX.

In the accompanying cuts, Fig. 1 is a side elevation of so much of a car-axle box as is necessary to illustrate the invention, the cap being elevated; Fig. 2 a detail view of the cap detached, and Fig. 3 a side view, partly in section, showing the lid down.

A represents the axle or oil-box of the ordinary construction, provided with vertical sides or ends. B is the usual opening in the front of the box for the insertion of



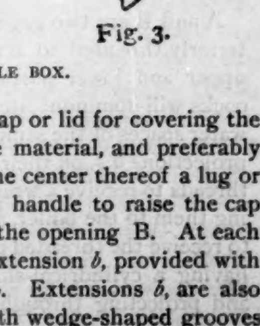


Fig. 2. Fig. 3.

SCOTT'S CAR-AXLE BOX.

the oil and packing. B' is the cap or lid for covering the opening B. It is of any suitable material, and preferably a rectangular plate, having in the center thereof a lug or protection a, which serves as a handle to raise the cap when it is desired to uncover the opening B. At each end or side of the cap B', is an extension b, provided with a pin b', at right angles thereto. Extensions b, are also provided on their inner sides with wedge-shaped grooves

c, as shown. These grooves *c*, are about one-half the width of the cap B′, terminating at the pin *b*′. It has been found expeditious and productive of excellent results thus to arrange these grooves. On the sides or ends of the box are formed wedge-shaped flanges *d*, which slide in the correspondingly-shaped grooves *c*, in the cap or lid of the box, thus locking the cover firmly to the box before the pivots *b*′, reach the bottom of the grooves *e*. The pins *b*′, slide in inclined grooves *e*, on each side of the box A, near its front end. Across the front end of the box at its top, is a ridge *f*, against which the knob or rivet *g*, in the cap B′, strikes and prevents the cap from being drawn further back and out of the grooves *e*. A lip or extension *e*′, of the grooves *e*, at the top of the box clearing the ridge *f*, permits the withdrawal of the pins and removal of the cap B′, from the box when the knob or rivet *g*, is removed from the cap. It will thus be understood that in order to fasten the cap upon the box securely and tightly, it will only be necessary to drop the cap and allow it to slide into position upon the box, and insert the rivet *g*, as seen in Fig. 3. When it is desired to open the box it is only necessary to push upward on the handle *a*, and the grooves and flanges will readily become unlocked, thereby allowing of the elevation of the cap B′ to the position seen in Fig. 1.

Importance is attached to the grooves *c*, arranged in the upper half of the cover, in their adaptability to serve with the flanges *d*, of the box, to wedge the lid firmly in place before the pins *b*′, reach the bottom of the slots *e*.

The inventor has assigned one-half the patent-rights to Fred L. Dilley, of the same place, to whom all communications should be addressed.

Bailey and Alexander's Automatic Water-Gage.

LEWIS C. BAILEY and W. SCOTT ALEXANDER, of McConnellsburg, Pa., are the inventors of an improvement in automatic water-gages, which is herewith illustrated and described. It is the object of the inventors to provide a water-gage which will act automatically to close both the water and steam-tubes of the gage should the glass indicating-tube be accidentally broken while the boiler is in operation. In the old form of water-gage if the glass tube be accidentally broken from any cause whatever, the steam and water will be forced out, so as to scald the engineer or other attendants before they can reach the cocks or valves to close or cut off the connection.

In the accompanying cuts, Fig. 1 is a longitudinal section of the water-gage and a portion of the boiler, illustrating the attachment, and Fig. 2 a detail view of the strainer.

A and B are two gage-cocks having their inner ends exteriorly threaded to screw into suitable openings at the upper and lower portions of the boiler G, so that the cocks will communicate, respectively, with the steam and water spaces of the same. The cocks A B, have hexagonal projections *a b*, on their inner ends forward of the exterior threads to receive a wrench or other instrument in attaching them to the boiler, and are interiorly threaded at E E, to receive the threaded ends of thimbles F F′, the latter, F′, having a cylindrical-shaped strainer C, formed therewith and projecting through the water of the boiler, so as to exclude dirt and other matter from passing into the cock, and yet permit the free circulation of water into the cock B.

The cocks A B, are each provided with a longitudinal passage D, extending through the same from the inner to the outer end, and a transverse passage I, extending through extensions H H′, projecting, respectively, downward and upward from the cocks A B. The glass tube J, is attached to the extensions H H′, which are threaded to receive stuffing-boxes K K, forming a water and air-

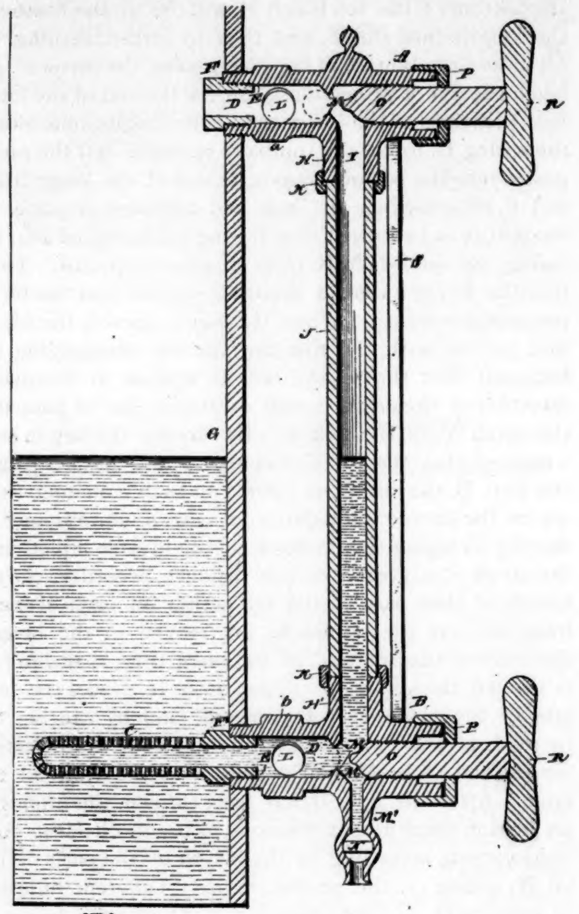


Fig. 1.

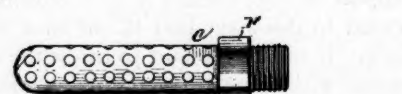


Fig. 2.

BAILEY & ALEXANDER'S AUTOMATIC WATER-GAGE.

tight connection therein. It will be seen that the longitudinal passages D, and transverse passages I, form a means of communication with the glass indicating-tube, so that the water from the boiler will enter the passage D, of the cock B, pass through the transverse passage I, and enter the glass tube to show the true depth of water in the boiler.

Arranged within the passages D, of the cocks A B, at their inner ends are balls L L, adapted to work in the passage, the thimbles F F′, preventing the balls from passing out into the boiler, pointed lugs M M, extending inwardly into the passage D, from the sides and at the forward ends thereof, and serving to limit the forward movement of the balls. A branch pipe M, extends downward from the cock B, and is provided with a valve or

cock N, through which to draw off the water from the glass tube to prevent freezing when not in use.

O is a stem or spindle threaded at one end to screw through the outer ends of the cocks A B, a stuffing-box P, being fitted over the ends around the stem to preserve a water-tight connection. The inner ends of the stem O, are rounded and project forward sufficiently, so that when screwed inward they will force the balls L L, backward or inward through the passage D, for the purpose hereafter explained. The outer ends of the stems O, are provided with hand-wheels R, for convenience in operation. Guard-rods S S, two in number, one of which is not shown in the cuts, are attached to the outer ends of the cocks A B, and serve to guard the glass tube from breakage.

The operation of the device will be readily understood from the foregoing description taken in connection with the accompanying cuts. The cock A, is attached to the upper portion of the boiler, and allows the passage of steam, and the cock B, is attached to the lower portion thereof, and permits the free circulation of water, the glass tube connecting the two cocks in the manner well known. As will be seen, the water from the boiler passes through the cock B, into the glass tube, so as to show the true depth of water therein, since the balls L L, do not interfere with the free passage of water and steam while the boiler is in operation. Should the glass tube be accidentally broken, the force of the steam and water will force it into the position shown in dotted lines in Fig. 1, the balls closing the outlet of the passage D, and thus preventing the escape of hot water and steam. In this manner a safety-gage will be provided which will be automatic in its action to prevent the scalding of the engineer should the glass tube be accidentally broken while the boiler is in operation. After a new glass tube has been replaced, the wheel R, is turned to cause the inner end of the stem O, to come in contact with the ball L, in the cock B, to force it back a slight distance until the water fills the glass tube, the same operation being repeated with the upper cock A, to admit steam, when both balls L L, will assume their natural positions, as seen in full lines in Fig. 1.

If, at any time, the boiler is empty and the glass tube is broken, and yet it is desired to fill the boiler to obtain a sufficient amount of steam, it is only necessary to screw the stem O, inward and against the lugs M M, to close the passage D, and there let it remain, since both balls will occupy the position shown in full lines when there is no water in the boiler. When the boiler is filled and in operation, there will be no force on the balls unless the glass tube should be broken. It will be seen that the balls will be allowed to move freely in the passages D, the thimbles F F′, limiting their movement inward, while the pointed lugs M M, provide a seat and hold them from forward movement. The strainer will exclude the passage of dirt into the cock B, and yet allow the free circulation of water to the glass tube. The balls act automatically to prevent, upon the breakage of the glass tube, the passage of water or steam outward to do injury to the attendants, and when the glass tube has been replaced by a new one, the stems O, are operated to restore the parts to their original positions.

The device is simple in construction, automatic in action, inexpensive to manufacture, and claimed to be of great utility for the purposes intended.

Wine's Car-Coupling.

HENRY WINE, of Marion, Ind., has recently invented an improved car-coupling which is herewith illustrated and described. In the accompanying cuts, Fig. 1 is a perspective view showing the car-coupling attached to the end of a car in position for operation; Fig. 2 a longitudinal vertical sectional view of the same; Fig. 3 a vertical transverse sectional view taken on the line x x in Fig. 2, and Fig. 4 a detail view showing the several parts of the car-coupling separated or detached from each other.

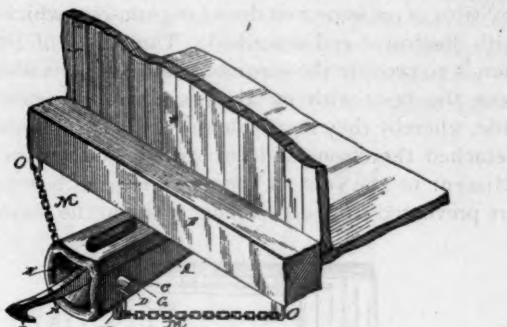


Fig. 1.

WINE'S CAR-COUPLING.

A is the draw-head of the car-coupling, which is suitably attached to or connected with the end of the car B. The draw-head A, is provided with the usual mouth or opening B′, and its sides are provided with openings C, forming bearings for a transverse shaft D. The latter is provided at one end with a head or handle E, and at its other end with a flange or feather F, for the passage of which the openings C C, are provided with rearwardly-extending slots G. Mounted upon the shaft D, is a

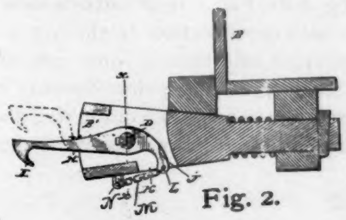


Fig. 2.

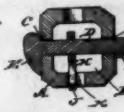


Fig. 3.

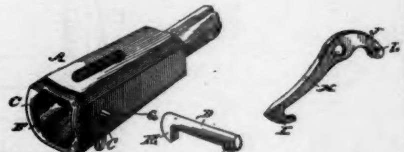


Fig. 4.

WINE'S CAR-COUPLING.

coupling hook H, the front end of which is formed with the hook I, adapted to engage the shaft D, of the draw-head of the opposite car, while its rear end is provided with an arm J, extending downward, as shown, through an opening K, in the bottom of the draw-head, and having a perforation L, with which is connected a chain M, which is secured in the eye at its middle, passes through eyes or staples N, at both sides of the under side of the draw-head, forward of the eye in the hook, and from these eyes to staples O O, at the sides of the platform of the car, so that the hook may be tilted upward by pulling either of the ends of the chain.

When desired, for the purpose of coupling with cars of unequal height, the coupling hook may be bent or twisted, as shown in dotted lines in Fig. 2 of the drawings.

The construction of this device is simple and inexpensive, and it is easily manipulated and certain in its action, while it be may be used in connection with the link-and-pin coupling.

Willson's Door for Grain-Cars.

CHARLES P. WILLSON, of Summit Point, W. Va., is the inventor of an improved door for grain-cars which is herewith illustrated and described. The object of the invention is to provide the separate board sections which compose the door with metal eyes which are open on one side, whereby they may slide on the vertical rods and be detached therefrom, and also to provide vertical guides adjacent to the vertical rods, whereby the board sections are prevented from detachment while in the doorway.

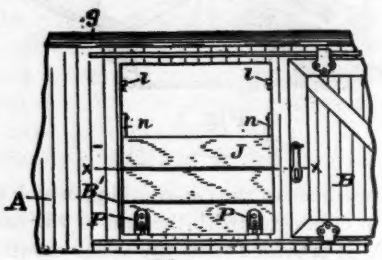


Fig. 1.

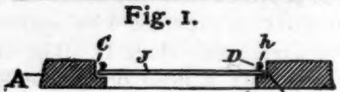


Fig. 2.

WILLSON'S DOOR FOR GRAIN-CARS.

In the accompanying cuts, Fig. 1 is an outside view of the car-door; Fig. 2 a horizontal section on the line $x\ x$; Fig. 3 a vertical section of one-half of one side of a car, showing the door; Fig. 4 an inside view showing the position of the door-sections when they close the doorway; Fig. 5 a view of an end of a section separately show-

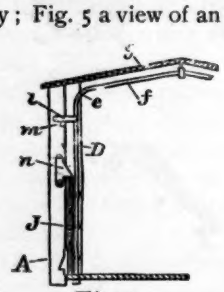


Fig. 3.

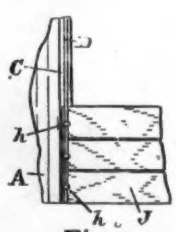


Fig. 4.

WILLSON'S DOOR FOR GRAIN-CARS.

ing the sheet-metal tip thereon to protect it; Fig. 6 a view of the eye attached to each section, and which slides on the rod, while Fig. 7 shows the lifting-lug on the lower section.

An ordinary box freight-car A, has a sliding door B. To adapt such cars for carrying grain in bulk, provision must be made for closing the lower part of the doorway B′, so as to make it tight enough to prevent the loss of grain. Heretofore this has been done by placing boards across the doorway on the inner side and nailing them to the door-frame. This, however, has been a resort of such a temporary nature as to prove both troublesome and expensive. The door to which this improvement relates consists of separate board sections, each provided with metal eyes and two vertical rods, one each side of the doorway, whereon the eyes slide, whereby the board sections may be raised and lowered to open or close the lower part of the doorway.

At each side of the doorway is a vertical rabbet-shaped guide C, which assists to keep the board sections in position as they move up or down.

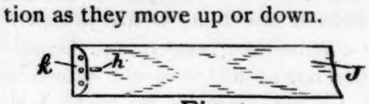


Fig. 5.

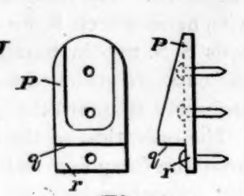


Fig. 7.

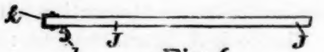


Fig. 6.

WILLSON'S DOOR FOR GRAIN-CARS.

Adjacent to each guide and partly occupying it is a rod D, the lower end of which is made fast to the bottom part of the car-frame. The upper part of this rod has a curve *e*, which gives it a nearly horizontal direction from the doorway toward the middle of the car, as seen in Fig. 3, where it is made fast. This nearly horizontal part *f*, of the rod is just below the car-roof *g*.

The board sections J, have near each end an eye *h*. Each eye takes loosely about one of the rods D, and is adapted to slide thereon. The end of each board section, is, preferably, protected by a sheet-metal tip *k*. (See Fig. 5.) The eyes *h*, as plainly shown in Figs. 2 and 6, are open at one side, in order to permit their detachment from the rods D. It will be seen by reference to Fig. 2 that both of the eyes on each board section have their open side in the same direction, from which it results that when the board section is moved endwise the open side of the eyes will allow them to disconnect from the rods. As long, however, as the board sections are in the doorway, or the ends of the board sections are confined by the guides C, this "endwise movement" cannot take place; but when the board sections are raised above the guides and passed over the curves *e*, on the nearly horizontal part *f*, then the endwise movement may be made.

When it is not desired to have the doorway closed by the board sections, they may be kept stowed out of the way just below the car-roof on the nearly horizontal part *f*, of the rods. To retain them from slipping down in front of the doorway, each side of the doorway-frame is provided with a pivoted hold-up or button *l*, whose free end, when in a horizontal position, projects across the path of the board sections. A stop *m*, below the pivoted button, prevents its turning down, but it is free to be lifted by a person's finger. It will be seen that in raising the board sections they will pass the hold-up button; but the latter device will prevent them from slipping down.

To hold the board sections down firmly to the floor, another button *n*, is pivoted to the side of the doorway-frame. This button must be adapted to allow the board sections to come down, but when all are down, prevent them from rising.

The lowermost board section is provided on the outer side with lifting-lugs P. This is a cast-metal plate to rest

against the section, and is attached by bolts. An under shoulder *q*, is to receive the end of a lever, such as a crow-bar, and the plate *r*, below the shoulder, is to protect the wood of the section from the end of the crow-bar. By this means all the board sections, which are held tightly by the lateral pressure of the grain, may be raised from the bottom of the car to allow the grain to flow out under the sections.

The expense incurred in using this improved device is slight, the additional cost being only that of the iron rods, eyes and catches, which are permament. The device is simple and not liable to derangement.

Varian's Adjustable Coal-Screens.

SAMUEL T. VARIAN, of East Orange, N. J., is the inventor of two improved screens for sifting coal and other material, both of which are herewith illustrated and described. Though similar in principle, they differ in construction and operation, and will be described separately. The first device consists of a screen composed of elliptical bars that are capable of partial rotation upon end pivots, so as to open or close the spaces between the bars, and thereby adapt the screen to the removal of dust and small coal from va: ious sizes of coal passing over such screen.

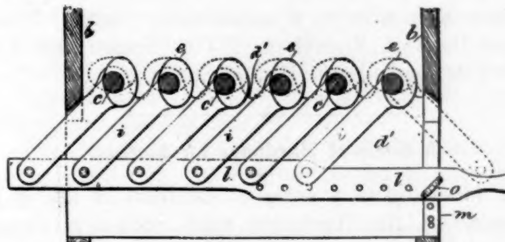


Fig. 1.

VARIAN'S ADJUSTABLE COAL-SCREENS.

In the accompanying cuts, Fig. 1 is a cross-section of the chute, showing the bars, their pivots in section, and the arms by which they are adjusted; Fig. 2 a section longitudinally of the chute, and Fig. 3 a plan view, partially in section. Figs. 4 and 5 on the succeeding page refer to the second device, which will be described hereafter.

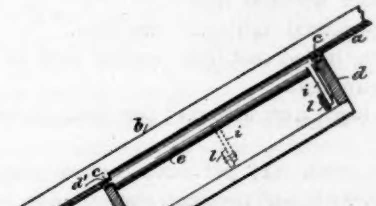


Fig. 2.

VARIAN'S ADJUSTABLE COAL-SCREENS.

The chute is composed of a bottom *a*, and sides *b*, and it is at an inclination, so that the coal or other material will run down the same, and it is to be of any desired size. The bars *e*, of the screen are preferably in line with the chute, and each bar has two pivots *c*, one at each end, and these pivots are received into holes or sockets in the end-bars or frames *d d'*. Each bar *e*, is elliptical or eccentric to its pivots, so that one edge of the bar is at a greater distance from the axis than the other edge. The sectional shape of each bar may be that of a flattened cylinder, or elliptical or polygonal; but preferably elliptical.

When the bars are swung so that their conjugate diameters are horizontal or in line with each other, as seen by dotted lines in Fig. 1, the spaces between the bars will be the narrowest, and when the bars are turned so that their primitive diameters are in line with each other, as shown by the full lines in Fig. 1, the spaces between the bars are the widest. The bars are therefore to be shaped and proportioned so that the openings will be within the required ranges of width for the various sizes of materials to be screened or separated from the materials passing over the bars. Each bar is provided with an arm *i*, at an angle of forty-five degrees to the conjugate diam-

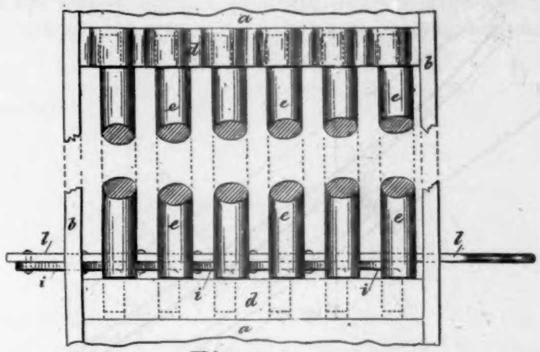


Fig. 3.

VARIAN'S ADJUSTABLE COAL-SCREENS.

eter, or nearly so, and the arms *i*, are connected by pivot-pins or screws, to the bar *l*, and this bar can be moved endwise and held in any desired manner—such, for instance, as by the pin *o*, inserted through a hole in the bar into one of the holes upon a cross-piece or segment *m*. These arms may be near the upper ends of the bars, as shown by full lines, or else near the middle, as shown by dotted lines in Fig. 2. By this construction the width of the openings between the bars may be varied, thereby allowing dust, or small coal or other material, to pass through and separate from the larger materials that slide down the chute and over the bars of the screen. The lower cross-bar or frame *d'*, is made with a corrugated or undulating upper surface, corresponding, or nearly so, to the bars *e*, near their lower ends, so that there are not any portions that project above the upper surfaces of the bars to interfere with the coal as it slides down the screen.

Figs. 4 and 5 refer to the second device, which is similar in principle and designed to effect the same purpose as the screen above described. This device provides for the combination, with a set of stationary bars, of a set of bars movable transversely beneath the stationary bars, so as to close partially the opening between such bars, and thereby adapt the screen to different sizes of coal or other material. The stationary bars have openings between them adapted to the screening of the largest sizes that are to be separated, and when the movable bars are slid laterally from beneath the stationary bars, the openings are reduced in size, and the screen is adapted to the screening of smaller sizes of coal.

In the accompanying cuts, Fig. 4 is a longitudinal section of the screen complete, and Fig. 5 a transverse section of the same. A A are the side pieces and B and C

the bottom portions of a chute that is placed at an inclination, and down which the coal or other material to be screened is caused to run. The bars E, are stationary and attached at their upper and lower ends to cross-bearers F G, placed across the chute, and the portion B, of the chute is usually made of sheet-iron above the upper ends of the bars E, while the portion C, of the chute is below the bars E, and even with the top of the cross-bearer G. There is also a cross-bearer H, beneath the bars E, and fastened to their under surfaces, so as to stiffen the bars and prevent lateral deflection. Beneath the bars E, there is a frame composed of the end-pieces I J, and connecting-bars L. The end pieces I J, are supported upon the cross-bearers F G, preferably by ribs O, so that the frame I J, and bars L, can be moved laterally

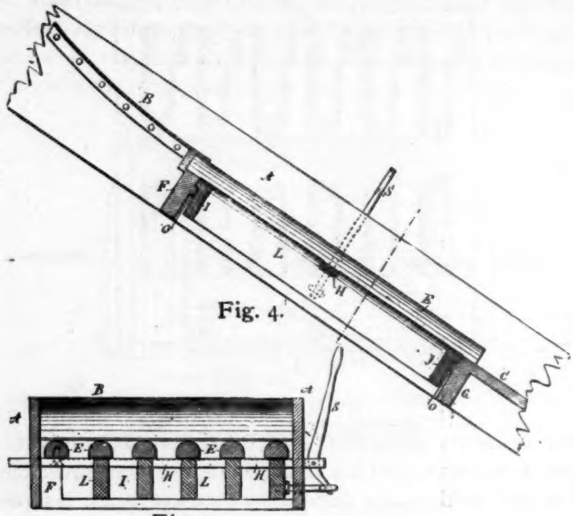


Fig. 4.

Fig. 5.

VARIAN'S ADJUSTABLE COAL-SCREENS.

across beneath the bars E. The bars I, are notched in their upper edges, where the stationary bar H, connects the bars E, so that the upper surfaces of the bars L, are close to the under surfaces of the bars E. By means of a lever S, or other suitable means—such as a screw—the frame I J L, is adjusted laterally and held in any desired position. When the bars L, are entirely beneath the bars E, the screen is adapted to the largest sizes of material, because whatever material is smalller than the distance between the bars E, will fall through, and the larger material will slide on the bars E, and run down the chute. If, now, the screen is to be adapted to smaller sizes, the frame I J L, is moved laterally, so that the bars L, partially close the spaces between the bars E, thereby adapting the screen to the separation, from the coal sliding down the chute, of all material that is sufficiently small to pass through between the lower edges of the bars E, and the upper edges of the bars L.

A New Wood Preservative.

AN antiseptic wood preservative which lately has made its appearance in the market and is recommended by exceedingly good testimonials is the "Carbolineum Avenarius." It acts in a mechanical and chemical manner. A liquid substance of very great specific gravity (about 1.14), it penetrates easily into the wood and forces out all water contained in the capillary cells and channels, while its fatty constituents do not allow any to reënter, and protect the timber against it, and against atmospheric influences. It contains about 20 per cent. of antiseptic bodies which have the effect of destroying all germs and preventing rotting, and decay and fungus, and kill the vermin and woodworm which may be in the timbers and prevent their generating in it.

The Carbolineum Avenarius is applied like paint with a brush. On exposure to the air it oxydizes and gives the wood a handsome nut-brown stain. Wherever possible it should be applied hot, since it will, in a thinner state, easier penetrate into the timber. No pressure or suction of any kind is necessary in its application, and steeping the timber in the substance is in many cases preferable to painting it. The substance is not at all inflammable, its boiling point being at about 295° Cent. or about 550° Fahr. and it may be kept in tightly closed vessels for any length of time without losing any of its useful qualities.

Its successful use upon railway-ties, bridges, telegraph-poles, sheds, flooring and shingles, has been demonstrated and asserted by many European government officials and railway managers, etc., and among others in this country, the Pennsylvania Railroad, the New York Central and Hudson River Railroad, the Union Ferry Company, etc., have given orders for its experimental use.

Captain Avenarius, of the German army, is the inventor of the Carbolineum Avenarius, which solves the problem of preserving timber to a considerable degree. Messrs. Schultze-Berge & Koechl, of 75 Pine Street, New York, are the sole agents in the United States.

A Scale of Hardness for Metals.

THE following is a scale of hardness in use in the laboratory of the Technical High School at Prague, composed of eighteen metallic substances, arranged in ascending order from the softest to the hardest:

1. Pure soft lead.
2. Pure tin.
3. Pure hard lead.
4. Pure annealed copper.
5. Cast fine copper.
6. Soft bearing metal (copper, 85; tin, 10; zinc, 5).
7. Cast iron (annealed).
8. Fibrous wrought iron.
9. Fine-grained light-gray cast iron.
10. Strengthened cast iron (melted with 10 per cent. of wrought turnings).
11. Soft ingot iron with 0.15 per cent. carbon (will not harden).
12. Steel, with 0.45 per cent. carbon (not hardened).
13. Steel, with 0.96 per cent. carbon (not hardened).
14. Crucible cast steel, hardened and tempered, blue.
15. Crucible steel, hardened and tempered, violet to orange-yellow.
16. Crucible steel, hardened and tempered, straw-yellow.
17. Hard bearing metal (copper, 83; zinc, 17).
18. Crucible steel, glass hard.

THE Housatonic Railroad announces two fast express-trains with drawing-room cars attached, leaving New York at 3:40 P. M. and Pittsfield at 4:15 P. M.